# HS East Anglia and North Kent Routes and Service Plans (HS11 and HS12)

# HS11/HS12 Route Mk1A

Following the referendum on EU membership and the decision to disengage from the EU, several changes have been made to the plans for HS rail, most importantly, abandoning GC-gauge, and building all new infrastructure to standard UK loading gauge. This has, in most cases, very little impact on the routes proposed, but significant impact on the service plans. In certain cases it is now proposed to include sections of classic route in the HS route, rather than building exclusively new throughout. (Note that this is different from the previous proposals to run classic compatible services on classic lines, **beyond** the HS route; this actually incorporates classic sections, upgraded as appropriate, in the HS route itself.) Appendix E lists all specific changes of route, for HS11/HS12 and associated routes, principally HS4, which are also, of course, incorporated in the various route sections, following.

Two specific new section of route need to be highlighted. The first is the section of HS11 from Stratford HS South Junction to Faversham. There is no way that this new infrastructure can be avoided, since it relieves the heavily-loaded GEML from Liverpool St. to Shenfield and Southend, and, less directly, relieves the North Kent line also. It further provides the necessary transport infrastructure to enable the development of two new towns, at Grain and Sheerness. I would also recommend building the new section between Pinewood Junction and Norwich, because of the enhanced capacity it provides for Ipswich, and also because it opens up the region of north east Norfolk, in particular Lowestoft and Yarmouth, which are at present poorly served, as well as serving Norwich.

Because of the significant changes introduced at Mk1A, the latest versions of all the Mk1 plans (v3.2 in the case of HS11/HS12) have been preserved, available in an archive section on the website.

# HS11/HS12 Route Mk2

As noted above, the Mk1A changes have, in general, little impact on the routes proposed (but great impact on the service plans). HS11/HS12 are exceptions to this. For HS11, the existing classic route between Faversham and Dover is incorporated, and, for HS12, the classic route between Shenfield North and Pinewood junctions. Mk1A may thus be viewed as a cut-down version of the original proposals, significantly quicker and less expensive to implement, but nonetheless delivering a large proportion of the advantages of those proposals.

This will not, however, satisfy the increasing capacity requirements beyond the fairly short term. HS11/HS12 Mk2 is therefore proposed, which is effectively the reinstatement of those parts of the original plans removed for Mk1A, on a piecemeal basis, as and when the build-up of traffic on Mk1A makes extra capacity desirable. For HS11, the section between Faversham and Canterbury East would be implemented, since the classic route over this section is significantly longer and severely curved. For HS12, the section between Shanfield North Junction and Colchester would be implemented, since capacity constraints are likely to become pressing over the medium term. The remaining sections – from Canterbury East to Dover and from Colchester to Pinewood Junction could well persist as incorporated

classic route in the long term, but if these were also implemented as new infrastructure, we would end up with the original design, but having enjoyed years of service from the MK1A version in the interim.

The current document thus retains all the original content, but rearranged to emphasise what is Mk1A and what is now Mk2.

This all comes about from abandoning GC-gauge. The original plans required so much new infrastructure, because it all had to be to GC-gauge. Building to UK loading gauge instead allows so much existing, first rate infrastructure to be incorporated.

# The Purpose, Background and Method

This article refers to and should be read in conjunction with my article 'Towards a High Speed **Network**'. That article sought to make the case for developing a network plan for all the HS routes which will eventually be needed, and, as a contribution to getting the discussion started, gave my own thoughts of what such a network could look like. Naturally, this involved describing a number of routes, in varying but superficial detail. This lays me open to the charge, something on the lines of 'That's all very easy to say, but how would you actually go about doing it?' Accordingly, a decent respect to the opinions of the interested public requires that I should go into more detail on the individual routes. The present article deals with HS11, the route from London to Southend, North Kent and Dover, and HS12, the route to Ipswich and Norwich, sharing the route of HS11 from London to Shenfield.

The general route is decided on strategic and business grounds, thus which locations are to be served. This gives the general alignment, at a very high, superficial level. I plan the detailed route using Ordnance Survey maps, taking careful account of the shape of the landscape, from the contours. I note the location of all significant infrastructure, thus tunnels (generally, over about a quarter mile in length), viaducts and major river crossings. I simultaneously make a virtual tour of the route from my computer, via satellite maps, to make sure, as far as possible, that there is actually room for my lines where I wish to put them, and that, for example, a housing estate has not materialised in an inconvenient location since the (paper) map was published. (I understand that the images used by satellite maps are up to a maximum of three years old, so not exactly real-time, but still pretty good.) I make a great effort to avoid any housing. I'm blasé about demolishing warehouses – after all, all that's required there is to build a (better) new one nearby, and the owners will be very happy. But I regard demolishing housing (or even getting very close to it) as a thoroughly bad idea; people just don't like it, and I understand their feelings. If ever I must (knowingly) propose to demolish housing, I will point out the fact.

These considerations apply in extreme form when, as in the present case, the route starts from London. Here there are simply no free routes available. The design has to follow an existing route, widened where there is space for it, (this involves searching, via satellite maps at a high magnification, where there is space to fit extra tracks within the existing alignment or where there is adjoining space to widen the alignment,) with recourse to tunnelling where there isn't.

In general I try to follow an existing alignment, railway or motorway, (or, very occasionally, of a nonmotorway road,) if there is a suitable one available, simply because it's there already, in the right place, with good layout, (somebody else has done all the hard work!) and, except in a very few places, there's plenty of room available adjacent to it. (In this context, motorways are particularly helpful. Nobody wants to live close to one, so house builders don't develop new estates at the side of motorways, leaving plenty

of space available for new railways.) Also, most importantly, it minimises disruption, and so I (optimistically, perhaps) expect it to maximise public support and minimise opposition.

When I am following an existing alignment, (this obviously includes taking over the route and trackbed of a former railway, now closed,) I don't generally worry about gradients, confident that they will be well within the capacity of HS trains. Very occasionally, when following a motorway or (more likely) non-motorway road, the contour pattern suggests that there might be a problem, and then I do check the gradients, (and state what these are, in the route plan). When I am obliged to design a completely new alignment, then the gradient profile forms part of the design, and will be stated, (unless, from the contours, it's obviously essentially level, or undulating but with no significant underlying change of level). The present article contains gradients for the very steep section where it follows the A2(T) between Faversham and Canterbury. Between Southend and Faversham the route is essentially level (except for the tunnels under the Thames and Medway, where the approach gradients are whatever we choose to make them, governed by the length of the approach).

I believe that this approach gives a route which in general terms is practicable and satisfies the requirements, though obviously a lot of work, especially detailed surveying on the ground, would be needed to turn it into an implementable design. Specifically, I can say nothing about cuttings and embankments, though I may note that a particular piece of landscape is strongly undulating, so cuttings and embankments will be required. Also, when I take the route alongside an existing railway or motorway alignment, I don't attempt to design it in any detail around (particularly motorway) junctions, although I do note on which side it runs, and wherever it is necessary to cross over to the other side.

# The Maps

Naturally, the chosen route must be illustrated with maps. I briefly describe the route, giving the map reference of all significant points (invariably of tunnel end points and significant river bridges), but the accompanying maps are the real definition. Mapping software can be very expensive, but fortunately the Ordnance Survey makes available, free of charge, the OS OpenData product suite, of which I use two components, the 1:250000 Scale Colour Raster data set and the Strategi Dataset. The former comes as a set of TIFF files, each containing one of the standard National Grid 100km Reference squares. These are easily converted into Microsoft Paint files and edited. These are, in other words, pure graphics, and are the basis of the detailed maps in the 'Route' section. The maps reproduced in the text all represent an area 20km in width (unless noted otherwise) and 10 km high (if the detail I wish to show will fit within that, but otherwise as high as necessary). They do actually contain contours, but not many; the scale is too small for contours to be really informative. For the present purposes, this scale is adequate; if you need more detail, use them as an index to the corresponding 1:50000 Landranger or 1:25000 Explorer maps.

The Strategi Dataset contains GIS (Geographical Information Systems) data, which has to be processed by special software; I have used the Open Source QGIS product. This has been used to produce an overall map of HS11/HS12, including sections of other routes over which HS11/HS12's services run. These overall maps come at the end of the 'Route' description, and also show HS11/HS12's classic compatible services on classic lines (these are shown as dotted lines). Also included there are maps of the overall HS Network.

In all the maps I use the following colour scheme for the various routes:

	standard colou	18
HS1 HS2	yellow dark red	R/G/B 255/242/0 255/242/0 R/G/B 136/0/21
HS2 HS3	red	R/G/B 237/28/36
HS4	brown	R/G/B 185/122/87
HS5	rose	R/G/B 255/174/201
HS6	indigo	R/G/B 63/72/204
HS7	green	R/G/B 34/177/76
HS8	turquoise	R/G/B 0/162/232
HS9	purple	R/G/B 163/73/164
<b>HS10</b>	lavender	R/G/B 200/191/231
HS11	orange	R/G/B 255/127/39
<b>HS12</b>	gray 50%	R/G/B 127/127/127
	custom colours	i
HS13	true blue	R/G/B 0/0/255
<b>HS14</b>	light blue	R/G/B 0/192/255
HS13	pure green	<u><b>R</b>/G/B 0/255/0</u>

standard colours

As the various route plans have been developed, the maps have been updated, so now they show all routes, as relevant. The maps in the present article are thus not limited to HS11/HS12.

# The Service Plans

The Route section of this document describes the complete lines in their final, full configuration (as far ahead as the plans consider). The service plans explain how that final state is reached: the order in which sections are opened, and the services which run on these partial configurations. The aim is always to get useful services running as soon as possible, to maximise return on the investment.

The service plans deliberately envisage maximum frequencies, to give an impression of just how much the system **could** accommodate. Initial services would certainly not be so intensive, probably no more than half of the frequencies quoted.

A standard HS station has two island platforms, thus two platformed tracks in each direction. If some of the services passing through the station are non-stop, then the main line must pass through the layout without adjacent platforms, either through the centre of the alignment, in tunnel below or on viaduct above, or the station must be on a branch loop off the main line, which thus bypasses it completely. In fact, all HS11/HS12 stations are served by all services, so don't need overtaking/avoiding lines. (In other words, all services on HS11 and HS12 are of type HS-Metro.) At the ends of a multi-destination route, the traffic density on the branches may not be sufficiently high to warrant this level of provision, so a single island platform (or two single platforms within some other arrangement) would suffice – this is the case with HS11 beyond Southend Airport, (except at Faversham, which has four platforms, shared with the classic route,) and with HS12 throughout (i.e. beyond Shenfield), except for Beccles, which has cross-platform interchange for Lowestoft and Yarmouth.

Several service plans are developed, reflecting the piecemeal development of the network. As new sections open, further services come into operation. In all cases, consideration is given to maximum loadings – which section(s) are fully loaded and thus determine the maximum service frequencies. I used to take 16tph as the maximum throughput, but, following new capacity calculations (expounded in appendix B of the article 'Same Speed Railways', which do include the effect of junctions,) I am now considerably more relaxed on this, and will countenance loadings of up to 24tph. (The quoted appendix contains my justification for this choice.) As stated above, the service plans deliberately quote maximum frequencies; initial services will almost certainly be to lower frequencies.

Two types of services are contained in the plans, those featuring High Speed trains which travel on HS11/HS12 for at least part of their journey, and those featuring Regional Metro (semi-fast) services on the corresponding classic route(s). Connections between the services (both HS and RM) are shown for the relevant interchange stations (the connections are usually cross-platform), together with the clock-face hourly departure plan. (Note that these plans are **representative**; the **actual** times are determined by the coordination of interchanges at multiple locations).

It is important always to bear in mind that the HS network is **not** a separate, stand-alone system, but an integral part of the complete railway network, hence the importance I attach to showing precisely how HS services interact with classic (RM) ones. (In this context it is worth pointing out that if, when HS lines come into service, the current ridiculous and illogical franchising system is still in operation, it will be necessary to include the corresponding classic route(s) in the same franchise as a HS route, with a strict contractual obligation on the franchisee to ensure close integration of HS and classic services. It certainly won't happen otherwise.)

# Estimated Journey Times

Following the service plans, estimated journey times are produced for all HS services. The assumptions and approximations made are explained.

# HS11/HS12 Route – Introduction and Assumptions

HS11 and HS12 closely follow existing alignments, railway and motorway, for most of the way. But HS11 has an entirely new alignment between Southend and Faversham (unsurprisingly), and HS12 has a new alignment for most of the way between (south of) Ipswich and Norwich..

HS11/HS12's long-term HS-Classic services begin at Liverpool Street, and the UHS and HS Metro services of both HS11 and HS12 are all cross-London inter-regional, via Euston Cross. This is an underground station with 6 platforms, (with passive provision for 8,) located on a west-east axis between Euston and St. Pancras / King's Cross stations, the precise location, horizontal position and depth, to be determined by the configuration of all the other tunnels in that area. Euston Cross and its approaches are shared by HS4 and HS2, UHS and HS Metro services only. It is a through station; nothing starts or terminates there. HS11/HS12's services via Euston Cross are the continuation into East Anglia and North Kent, of HS4's services from South Wales and (in conjunction with HS7) the West Country. Appendix A gives full details of Euston Cross and its approaches. Full details of the services on HS4/HS7 are

contained in the article 'HS4 Route and Service Plans'. Summary details of the inter-regional services are in the service plans of the present article.

HS11 begins at Stratford HS South Junction, where HS4 diverges from HS2, on the eastern route from Euston Cross, and metamorphoses into HS11. HS11/HS12's classic-compatible services begin at Liverpool Street, and join HS11 at Manor Park Junction, just after HS11 has emerged from tunnel on the north side of the GEML. HS12 itself begins at Shenfield HS Junction, where it diverges from HS11.

The maximum speed for HS11/HS12 is 300kph, 187.5mph, throughout; the non-stop runs are not long enough to take advantage of a higher speed, and 300kph is adequate, with no detriment to the service provided, and with significant savings in construction costs.

## HS11 Route – Junctions

There are various junctions on the route of HS11, enabling connections with other HS and classic routes. These are identified in the description of the route, but it is convenient to list them all here, together with their map references and identifying remarks, since, when discussing the capacity/loading of different sections of route, the end points are usually junctions (occasionally stations). The junction names are my own suggestions.

•	Stratford HS	TQ387847	HS4 diverges from HS2 immediately east of Stratford HS South,
	South		and metamorphoses into HS11. (The given location is approximate
			– it's underground!)
•	Manor Park	TQ422858	Allows classic-compatible services from Liverpool St. to join HS11.
•	Shenfield HS	TQ624961	HS12 diverges from HS11.

#### HS12 Route – Junctions

•	Shenfield HS	TQ624961	HS12 diverges from HS11.
•	Shenfield	TQ629970	Connects HS12 to classic GE route just north of Shenfield.
	North		
•	Colchester HS	TL995263	Connects HS12 to classic GE route just east of Colchester station.
•	Pinewood	TM152413	Connects HS12 to classic GE route south of Ipswich station.
•	Westerfield	TM178473	HS12 merges with the East Suffolk Line immediately after the
			Felixstowe branch has diverged).
•	Woodbridge	TM265477	HS12 diverges from East Suffolk Line.
•	Belle Grove	TM402808	HS12 merges with the East Suffolk Line (which has been
			redoubled)
•	Beccles	TM425906	Classic route to Lowestoft diverges from HS12 immediately north
			of Beccles station (see also Appendix B).
•	Reedham	TG423010	Classic route to Yarmouth diverges from HS12 (see also Appendix
	South		B).

There are various other links between HS11/HS12 and classic lines, for operational purposes and not intended for regular services, so not relevant in the present context. Although HS11 extends eventually to Dover, there are no junctions other than Buckland West HS carrying a scheduled, regular service.

There now follows the definition of the actual route, in several logical sections.

## 1. Euston Cross – Shenfield



1.1 Euston Cross - RomfordContains Ordnance Survey data © Crown copyright and database right 2013Note that this map is slightly wider than 20km (c21km).

HS4 arrives at Stratford HS South in tunnel from Euston Cross, which it shares with HS2. It diverges from HS2 at Stratford HS South Junction (TQ387847), immediately east of the station, and changes its identity to HS11. (Appendix A gives full details.) It emerges from tunnel at TQ420858, on the north side of the GEML alignment. It is joined at Manor Park Junction (TQ422858) by a connection from the classic route, from Liverpool Street, used by classic-compatible services. It enters a 2 mile tunnel just past



1.2/2.1 Hornchurch – Billericay Conta

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the North Circular Road, at TQ432864, emerging after Goodmayes station (TQ467875). It tunnels beneath Chadwell Heath station, emerging on the south side of the GEML alignment at TQ478876, and follows this to Waterloo Road, Romford, TQ57810882, entering a 1 mile tunnel and emerging at TQ522888, just after the Upminster branch has diverged. Finally it crosses to the north side of the alignment at TQ532895, just after Gidea Park.

Alternatively, cut the crap and take a 6<sup>1</sup>/<sub>2</sub> mile tunnel from the North Circular Road at TQ432864, and emerge, still on the north side of the GEML at TQ532895 after Gidea Park. (This is the option illustrated on the map, above.)

HS11 follows the north / west side of the GEML from Gidea Park to Shenfield. There is a choice of a short tunnel or demolishing ~6 houses at TQ652944.

## 2. Shenfield – Southend Airport

HS11 has a very short (¼ mile) tunnel at Shenfield, because of encroachment of housing on the north / west side of the station. The two HS island platforms are immediately north of the Rayleigh Road bridge (where there is adequate room, currently a car park). It takes over and doubles the single line diverging and passing under the GEML, which I believe will no longer be required once Crossrail opens. HS12 diverges at TQ624961, Shenfield HS Junction, and joins the south east side of the GEML alignment.

HS11 follows the north side of the alignment of the Southend line. It tunnels under Billericay for 1 mile between TQ663953 and TQ681949. At TQ735944, shortly before Wickford, it diverges on a new alignment. The new alignment between Wickford and Hockley straightens out the long curve through Rayleigh. HS11 tunnels beneath Wickford for <sup>3</sup>/<sub>4</sub> mile between TQ743944 and TQ755945. It crosses the

River Crouch at TQ775942, crossing Hullbridge Road at TQ807936 and passing to the south of Hullbridge. It rejoins the north side of the Southend line at TQ823930, just before Hockley, following that to TQ850926, where it crosses to the south side, just past White Hart Lane (another one).

It follows the south, then west side of the alignment past Rochford, to Southend Airport. Here the standard double island station has the HS11 tracks on the outside, so the down track crosses the classic line just north of the Airport station, and the up line crosses just to the south. The lines continue for a short way south, with a reversing siding between them. This allows trains to reverse here. Initially, HS11 opens to the airport, and all services terminate here until the next section, containing the Thames and Medway tunnels, opens. (This reversing facility may well be needed long-term, by a cross-London inter-airport night-time service, for example.)



2.2 Billericay - Southend

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## 3. Southend Airport – Faversham

HS11 continues beyond the airport station along the east side of the classic line as far as TQ881865, just north of Southend Victoria, where it enters the  $6\frac{1}{2}$  mile tunnel under the Thames to Grain. Southend HS station is located just inside the tunnel, under Southend High Street between Victoria and Central stations, with pedestrian connections at the ends to both. (If this distance significantly exceeds the HS station length, then it is located to give the best connection to Southend Central station, on the Tilbury line – since the line to Southend Victoria already has a cross-platform connection with HS11 at Southend Airport.)



 3.1 Allhallows – Uplees
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HS11 emerges from the Thames tunnel at TQ844780 on the Isle of Grain (or is it still the Hoo Peninsula?) It takes over and follows the trackbed of the long-closed line to Allhallows on Sea for a little over a mile,

to TQ845784 then veers east to the new station of Grain, at TQ852758. This is envisaged as the focus of the new town of Grain, incorporating the villages of Allhallows, Stoke and Grain itself.

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HS11 enters a further 3<sup>1</sup>/<sub>2</sub> mile tunnel at TQ858756, passing under the Kent Oil Refinery and the River Medway and emerging at TQ911731, on the Isle of Sheppey, at the new station of Sheerness HS, adjacent to the existing classic branch from Sittingbourne to Sheerness, on which a new interchange station is opened. This is likewise envisaged as the focus of the new town of Sheerness, merging Minster, Halfway Houses and Queensborough into the existing town of Sheerness.

It may seem a bit like the tail wagging the dog to plan a new railway and then add a couple of new towns for it to serve, but demand for housing in the South East is intense, and Hoo and Sheppey have plenty of development space available and, (with respect to all those who love them,) neither could reasonably be described as being of outstanding natural beauty, which would be ruined by housing, so all that's holding them back is the lack of decent transport to London, which HS11 amply rectifies. Metroland for the 21<sup>st</sup> century?

From Sheerness HS station, HS11 follows the east side of the A249 to TQ928714. It then takes a straight line to TQ980688, near Spitend Point, where it enters a ½ mile tunnel under The Swale, emerging in mainland Kent at TQ990655. It joins the north side of the alignment of the North Kent line at TQ997613, just west of Faversham, and follows this to Faversham station. The station already has two island platforms. The down classic line crosses over HS11, which occupies the inner platform faces while the classic lines take the outer ones. The lines of HS11 continue for s short distance east, between the classic lines, with a reversing siding between them. This reversing facility will certainly be needed long term.

## 4. Faversham – Dover

At Mk1A, HS11 merges with and shares the tracks of the classic route from Faversham to Dover, via Canterbury East. The rest of this section describes the situation at Mk2. It is expected that Mk2 will include at least the new section from Faversham to Canterbury East, and possibly all the way to Dover. One feature of the original Mk1 plans which will not be implemented is the restoration of the former Buckland West Junction, to allow for through services to Margate via Deal. Services on the Dover – Margate route are now associated with HS1 (refer to the HS1 Route and Service Plans article.)

HS11 follows the north side of the alignment as far as TR031600, just after the A2 has crossed, and then diverges, to join the southern side of the A2 alignment at TR036600, just before the M2 joins it. It continues along the south side of the A2(T) until TR127575, where the Faversham – Canterbury line crosses. It joins the north side of this and follows it to Canterbury East station. Canterbury East is on a cramped site, but there would be room on the north side for the single HS island if the station building were removed, and a new building, over the tracks, say, provided.



4.1 Faversham – Canterbury Contains Ordnance Survey data © Crown copyright and database right 2013

Following the A2(T) results in a significantly shorter route between Faversham and Canterbury, at the expense of steeper gradients. Actually the gradients are very steep: eastbound from Boughton Street to Dunkirk involves a climb of 101m in 3km – 1 in 30, which is close to the limit for HS trains, (the Cologne – Frankfurt line has a maximum gradient of 4%, i.e. 1 in 25,) and much steeper than I like. (The corresponding gradient westbound is only 1 in 59.) Alternatively, HS11 could follow the north side of the classic line between Faversham and Canterbury (there are no obstructions), but this would be significantly slower because of the curvature (and the extra distance).



4.2 Adisham – Dover

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There are several obstructions in Canterbury, beyond East station, so HS11 enters a 1 mile tunnel at TR146573, emerging at TR166571, still on the north side of the classic alignment. It continues on the north side almost as far as Dover. There are surprisingly few obstructions. At Adisham station it is necessary to divert HS11 say 100yds to the east, to avoid the station buildings and a few others. At Shepherds Well there are obstructions, but the station is shortly followed by Lydden tunnel; HS11 commences its Lydden tunnel a little earlier, at TR257483. A very short (¼ mile) tunnel is required under Kearsney station, between TR288441 and TR291438. HS11 crosses to the south west side of the alignment immediately Buckland Junction. It follows this to Dover Priory station, in tunnel (¼ mile) between TR313418 and the station. The HS station is on the west side, and has 4 platforms, being shared by HS11 and HS1.

## 5. Shenfield – Ipswich

HS12 diverges from HS11, after crossing under the GEML, at Shenfield HS Junction (TQ620962). Shortly after, at Shenfield North Junction (TQ625966) there is a connection between HS12 and the classic route to allow classic-compatible services to reach the GEML.

At Mk1A, HS12 merges with and shares the tracks of the GEML from Shenfield North Junction to Pinewood Junction. The following describes the original proposal, much of which, at least as far as Colchester, is likely to be included in Mk2

HS12 follows the south / east side of the GEML alignment until Chelmsford. It diverges from this by ~100yds to the east past Ingatestone station, to avoid buildings there (there's plenty of space available behind them). It enters a 1 mile tunnel at TL696052, at the boundary of Chelmsford, and emerges on the north / east side of the alignment at TL700062. There is ample room for the HS platform island on the north west side of Chelmsford station, but it will be necessary to demolish a few buildings (3? Houses? Shops?) on Duke Street, immediately before the station. There is unobstructed room beyond the station all the way out of Chelmsford, but just one track width on either side of the alignment. So the classic lines will need to be slewed one track width to the south east, to accommodate the two HS tracks on the north west side.

A short tunnel (¼ mile) is needed at Boreham, between TL759106 and TL762107, and another, (1 mile,) under Witham station, between TL809141 and TL823154, just past where the Braintree branch diverges.

A short (½ mile) tunnel, between TL905231 and TL911237, is needed on the approach to Marks Tey. Marks Tey station is relocated, a little to the north at TL920241, to allow a connection from the Sudbury line of the Colne Valley Metro to link to the up line of the GEML, enabling cross-platform interchange on both sides. HS12 crosses to the south / east side of the alignment at TM916240, sharing the overbridge with the link from Sudbury. (Appendix C gives a possible layout.)

HS12 runs between the GEML and the A12 for 2 miles then crosses back to the north side of the GEML alignment at TL946253, and follows that to Colchester station. There's plenty of space for the HS platforms on the north side, presently car parking. A Connection between HS12 and the classic route at TL995263 (Colchester HS Junction) allows classic-compatible services to reach the classic route.

HS12 continues along the north / west side of the GEML alignment almost to Ipswich. It passes through a 1 mile tunnel under a built-up residential area between TM010264 and TM025270, and is then completely unobstructed to Manningtree. Several warehouses or industrial buildings need to be relocated around TM107328, on a promontory into the Stour estuary, south of Cattawade. A short tunnel (¼ mile) is required, under Station Road, Bentley, between TM119367 and TM120370, or demolish several houses. HS12 connects to the GEML at Pinewood Junction, TM152413, allowing services to reach Ipswich on classic tracks. HS12 diverges from the GEML at Pinewood Junction, and enters a 3½ mile tunnel under Ipswich, at TM155423. Ipswich HS station is in tunnel, directly beneath the classic station, and at a right angle to it.







# 6. Ipswich – Norwich

HS12 emerges from its tunnel under Ipswich at TM166462, and curves gently to the east to join the East Suffolk Line at TM178473, Westerfield West Junction, just after the Felixtowe branch has diverged. It takes over the trackbed, still double as far as Woodbridge, for the next 5½ miles. The service to Yarmouth HS11/HS12 Route and Service Plans v5.0 Page 17 of 74

and Lowestoft, via the East Suffolk Line, shares new route under Ipswich, via the underground HS station. HS services thus avoid the freight traffic from Felixstowe.



Note that this map is slightly wider than 20km (c.22km)

The East Suffolk Line is not particularly well aligned, and the area through which it passes is essentially flat and very sparsely populated, outside the few, small towns that the line serves. HS12 accordingly takes a new alignment, for high speed. The alignment given here is a suggestion; it could doubtless be significantly improved by ground surveys.

HS12 diverges from the East Suffolk alignment at TM265477, Woodbridge Junction. It crosses the Deben and passes over the disused Woodbridge Airfield, crossing the B1084 at TM352502. It passes to the west of Butley, crossing the B1078 Orford Road at TM366550, then to the east of Blaxhall, and passes close to the East Suffolk Line for a short distance around TM378592. It passes to the east of Saxmundham, and rejoins the East Suffolk Line at TM397660, following it on the east side until TM405709. It passes to the east of Halesworth, crossing the B1123 at TM410774. It rejoins the East Suffolk Line at TM402808, Belle Grove Junction, and again takes over the redoubled trackbed. It then follows the East Suffolk route to north of Beccles.



Beccles is a standard HS station with 2 island platforms. Normally HS12 's Norwich service will take the two inner platform faces, and the Yarmouth and Lowestoft service the outer ones, but scissors crossovers are provided for operational flexibility. The Lowestoft line diverges at Beccles Junction, TM425906, immediately north of the station. The Yarmouth service continues along HS12 for a few miles. Above

Beccles, HS12 again has a completely new alignment. My first thoughts were to use the former alignment to Haddiscoe on the Norwich – Lowestoft line. But there is almost no trace of it on the ground; it has been more comprehensively obliterated that any other former alignment I have considered. Therefore HS12 heads due north, passing to the west of Haddiscoe village and crossing the B1136 at TM437972. The classic route to Yarmouth diverges from HS12 at Reedham South Junction, TG423012, and joins the Norwich – Lowestoft line, serving a new station, Reedham South, at TG422016, immediately after crossing the River Yare, after which it diverges over a restored, former connection to the Yarmouth line via Berney Arms. Appendix B depicts the configurations at Beccles and Reedham.



6.3 Beccles - Bramerton

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HS12 keeps on the south side of the Yare, crossing a minor road at TG367021, it passes north of Ashby St. Mary, south of Rockland St. Mary and Bramerton, entering a 1 mile tunnel at TG254065, just before the A47(T), emerging at Carrow Road, TG243080, just before Norwich station, where it joins HS6 in the HS platforms on the south side.



# **Overall Maps**

There follow maps of the overall HS11/HS12 routes. Those portions of the main lines of HS11/HS12 which incorporate sections of classic route, and the sections of HS-Classic services extending over classic routes beyond the HS11/HS12 main lines, are shown as dotted lines, but differently. The following schematic should clarify:

 HS11: HS Line (main line - new infrastructure)
HS-Classic (classic section incorporated within HS main line)
 HS-Classic (HS services extending over classic lines beyond HS main line, in general as the final section of the journey, especially at the 'country end' - away from London).
HS12:
 HS Line (main line - new infrastructure)
 HS-Classic (classic section incorporated within HS main line)
 HS-Classic (HS services extending over classic lines beyond HS main line, in general as the final section of the journey, especially at the 'country end' - away from London).

The first map shows the HS11/HS12 routes at Mk1A. It shows the alignments changed from Mk1, including sections of classic route incorporated into HS11/HS12. This are followed by the full Mk2 version of the same sheet. Finally the maps of the overall network are presented, in Mk1A and extended form. Note that these will be updated over the coming months as the various Route and Service Plans articles are reissued incorporating the Mk1A changes.



HS11/HS12 Route and Service Plans v5.0



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# The Service Plans

A new service plan comes into effect when some significant change takes place which causes a change to the service loadings of one or more sections of HS11/HS12 themselves. This most commonly occurs when a new section of HS11 or HS12 opens, but it may also be a consequence of a change on some other HS route.

The service plans use the following notation:

- tph trains per hour
- H High Speed train at least part of the journey being on the HS main line
- R Regional Metro train, semi-fast service
- RS Regional Metro train, stopping service (all stations)

High Speed trains invariably travel over classic lines also (even if only those sections incorporated in the HS main line). Regional Metro services generally travel their entire journey over classic lines, though this is not an absolute requirement; but if they do travel over any HS section, they must be formed of HS stock – obviously!

Occasionally other notations are used; these will be defined when used.

As was mentioned earlier, the service plans deliberately envisage maximum frequencies. The results may thus seem, at least initially, somewhat optimistic.

# Service Plan 1

Service Plan 1 comes into effect when HS11 and the first few yards of HS12 open from Manor Park Junction to Shenfield North Junction (thus independent of Euston Cross). (We're talking here of new HS infrastructure.) The section of GEML from Shenfield North Junction to Norwich is upgraded to a line speed of 140mph and incorporated in HS12. HS-classic services from Liverpool Street are involved, and these replace the classic services to Norwich, Lowestoft, Harwich, Clacton/Walton and Braintree (and thus morph into HS12 services!). There are no dependencies on any other HS route. The following HS12 services are introduced (there are no HS11 services at this SP):

- 2tphH Liverpool Street Stratford Shenfield HS Colchester Ipswich Diss Norwich
- 1tphH Liverpool Street Stratford Shenfield HS Colchester Ipswich Woodbridge Wickham Market – Saxmundham – Darsham – Halesworth – Brampton – Beccles – Oulton Broad South – Lowestoft
- 2tphH Liverpool Street Stratford Shenfield HS Colchester Manningtree Mistley Wrabness Harwich Parkeston Quay Dovercourt Harwich Town.
- 2tphH Liverpool Street Stratford Shenfield HS Chelmsford Witham Kelvedon Marks Tey – Colchester – Wivenhoe – Thorp le Soken (splits/joins) – :

- Clacton

- Frinton Walton
- 2tphH Liverpool Street Stratford Shenfield HS Chelmsford Witham White Notley Cressing – Braintree Freeport – Braintree

**Regional Metro:** 

- 2tphR Liverpool St. Shenfield GEML Ingatestone Chelmsford Hatfield Peverel Witham – Kelvedon – Marks Tey – Colchester – Wivenhoe – Thorpe le Soken (splits/joins) – : – Clacton
  - Kirby Cross Frinton Walton-on-Naze
- 2tphR Liverpool St. Shenfield GEML Ingatestone Chelmsford Hatfield Peverel –Witham White Notley Cressing Braintree Freeport Braintree
- 4tphRS (Colne Valley Metro) Sudbury Bures Chappel & Wakes Colne Marks Tey Colchester – Colchester Town (reverse) – Hythe – Wivenhoe – Alresford – Great Bentley – Weeley – Thorpe-le-Soken (splits/joins) –
  - Clacton
  - Kirby Cross Frinton Walton-on-Naze
- 2tphRS (Felixstowe Metro) Ipswich Westerfield Derby Road Trimley Felixstowe
- 2tphR Harwich Town Harwich International Ipswich Bury St. Edmunds Ely March Peterborough – Stamford – Oakham – Melton Mowbray – Leicester – Hinckley – Nuneaton – Coleshill Parkway – Birmingham New Street – University – Bromsgrove – Droitwich Spa – Worcester Shrub Hill
- 2tphRS (Bury St. Edmunds Metro) Ipswich Needham Market Stowmarket Elmswell Thurston Bury St. Edmunds (split/join) –:
  - Kennett Newmarket Dullingham Cambridge
  - Kennett Soham Ely Manea March Whittlesey Peterborough

Representative Hourly Non-Cross-Platform (but see Appendix C) Interchange Pattern at Marks Tey:

- 00H Liverpool Street Clacton / Walton RS Clacton / Walton – Sudbury (thus connecting Liverpool Street – Sudbury)
- 07H Clacton / Walton Liverpool St.
   RS Sudbury Clacton / Walton (thue connection Sudbury Liverpool St.)
- 15R Liverpool Street Clacton / Walton
   RS Clacton / Walton Sudbury (thus connecting Liverpool Street Sudbury)
- 23R Clacton / Walton Liverpool St.
  RS Sudbury Clacton / Walton (thue connection Sudbury Liverpool St.)
- repeating at 30, 37, 45 and 53 minutes past.

Representative Hourly Non-Cross-Platform Interchange Pattern at Colchester:

- 00H Liverpool Street Norwich
  - H Liverpool Street Clacton / Walton
- 07H Liverpool Street Harwich RS Sudbury – Clacton / Walton
- 15R Liverpool Street Clacton / Walton (no connection)

#### 23H Liverpool St – Lowestoft

RS Sudbury - Clacton / Walton

- repeating at 30, 37 and 45 minutes past.(not 50, and the Lowestoft service is only 1tph at this SP).

Representative Hourly Non-Cross-Platform Interchange Pattern at Ipswich:

- 00H Liverpool Street Norwich
  - R Harwich Town Worcester Shrub Hill
  - RS Ipswich-Felixstowe
  - RS Ipswich Cambridge / Peterborough

- repeating at 30 minutes past (see Appendix D for elucidation of this interchange pattern, as there is much hidden detail).

With this service plan, all the stations on the GEML beyond Shenfield retain their existing services at the same or better frequencies, but a little faster. The accelerations will not be huge; it's not far between Manor Park and Shenfield. Further accelerations will come when HS12 is extended to Ipswich, but this is not foreseen for the immediate future; attention will initially be focused on HS11.

It imposes the following loadings on HS11:

٠	Liverpool Street	– Manor Park Junction	9tph
•	Manor Park Junction	- Shenfield HS Junction	9tph
•	Shenfield HS Junction	- Southend Airport station	0tph
•	Southend Airport station	– Faversham station	0tph
•	Faversham station	- Buckland West HS Junction	0tph
•	Buckland West HS Junction	– Dover Priory station	0tph

It imposes the following loadings on HS12:

•	Shenfield HS Junction	<ul> <li>Shenfield North Junction</li> </ul>	9tph
•	Shenfield North Junction	– Witham	11tph
•	Witham	– Colchester	9tph
•	Colchester	– Manningtree	5tph
•	Manningtree	– Pinewood Junction	3tph
•	Pinewood Junction	– Ipswich (GEML)	3tph
•	Ipswich (GEML)	– Norwich Thorpe via Diss	2tph
•	Pinewood Junction	- Woodbridge Junction	0tph
•	Ipswich (GEML)	- Belle Grove Junction	1tph
•	Belle Grove Junction	– Beccles Junction	1tph
•	Beccles Junction	– Lowestoft	1tph
•	Beccles Junction	– Norwich HS	0tph

Note that these loadings, from Shenfield North Junction onwards, are for the sections of classic GEML and other routes merged into HS12, They include both the HS and RM services; there will be other traffic, including freight.

# Service Plan 2

Service Plan 2 comes into effect when:

- HS11 opens from Manor Park Junction to Stratford HS South Junction, and thus connects to the route to Euston Cross, which is already in service for HS2.
- HS11 opens from Shenfield HS Junction to Southend Airport.
- HS4 opens from Old Oak Common West to East Junction, and thus connects to the route to Euston Cross, which is already in service for HS2. (Apart from the shift of four services from Paddington to the Euston Cross route, thus becoming through services with HS11/HS12, this involves no change to HS4; this is HS4 SP2.)
- HS7 opens from Birmingham HS (Curzon St.) to Bristol Temple Meads (this is HS7 SP 1).

As has been explained, Euston Cross is a through station, **all** services are through services. There are 4 (HS4) services west from Euston Cross, thus there must be 4 balancing services east on HS11/HS12.

HS11:

The following services are introduced on HS11 (including their HS4 origins):

- 2tphH Cardiff (Rhoose) Airport Cardiff Newport Bristol Parkway Swindon Reading Parkway LL – LHR Interchange – Old Oak Common – Euston Cross – Stratford HS South – Shenfield HS – Southend Airport.
- 2tphH Bristol Temple Meads BT Bristol Parkway Swindon Reading Parkway LL LHR Interchange – Old Oak Common – Euston Cross – Stratford HS South – Shenfield HS –Southend Airport.

(BT means Brunel Trainshed, which are terminal platforms, as opposed to Bristol Temple Meads which is on the through route to the West Country.)

We assume the following RM service to Southend Victoria:

 4tphRS Liverpool Street – Stratford – Shenfield – Wickford – Rayleigh – Hockley – Rochford – Southend Airport – Prittlewell – Southend Victoria

Representative Hourly Cross-Platform Connections at Southend Airport:

- 00H Cardiff Airport Euston Cross Southend Airport RS Liverpool Street – Southend Victoria
- 15H Bristol Temple Meads BT Euston Cross Southend AirportRS Liverpool Street Southend Victoria

- repeating at 30 and 45 minutes past. (As an interchange facility this is currently no big deal, but will be, when HS11 is extended.)

HS12:

The following services on HS12 have HS4 origins:

 2tphH Swansea – Neath – Port Talbot – Bridgend – Cardiff (Rhoose) Airport – Cardiff – Newport – Bristol Parkway – Swindon – Reading Parkway LL – LHR Interchange – Old Oak Common – HS11/HS12 Route and Service Plans v5.0
 Page 33 of 74 Euston Cross – Stratford HS South – Shenfield HS – Chelmsford – Colchester – Ipswich – Diss – Norwich (existing service as at SP1, but now starting in Swansea).

 2tphH Bristol Temple Meads – Bristol Parkway – Swindon – Reading Parkway LL – LHR Interchange – Old Oak Common – Euston Cross – Stratford HS South – Shenfield HS – Chelmsford – Colchester – Ipswich – Diss – Norwich (note that this is a new service).

The remaining services, still from Liverpool St., are unchanged from SP1:

- 1tphH Liverpool Street Stratford Shenfield HS Colchester Ipswich Woodbridge Wickham Market – Saxmundham – Darsham – Halesworth – Brampton – Beccles – Oulton Broad South – Lowestoft
- 2tphH Liverpool Street Stratford Shenfield HS Colchester Manningtree Mistley Wrabness Harwich Parkeston Quay Dovercourt Harwich Town.
- 2tphH Liverpool Street Stratford Shenfield HS Chelmsford Witham Kelvedon Marks Tey – Colchester – Wivenhoe – Thorp le Soken (splits/joins) – :
  - Clacton
  - Frinton Walton
- 2tphH Liverpool Street Stratford Shenfield HS Chelmsford Witham White Notley Cressing – Braintree Freeport – Braintree

#### Regional Metro:

- 2tphR Liverpool St. Shenfield GEML Ingatestone Chelmsford Hatfield Peverel Witham – Kelvedon – Marks Tey – Colchester – Wivenhoe – Thorpe le Soken (splits/joins) – : – Clacton
  - Kirby Cross Frinton Walton-on-Naze
- 2tphR Liverpool St. Shenfield GEML Ingatestone Chelmsford Hatfield Peverel Witham White Notley Cressing Braintree Freeport Braintree
- 4tphRS (Colne Valley Metro) Sudbury Bures Chappel & Wakes Colne Marks Tey Colchester – Colchester Town (reverse) – Hythe – Wivenhoe – Alresford – Great Bentley – Weeley – Thorpe-le-Soken (splits/joins) –
  - Clacton
  - Kirby Cross Frinton Walton-on-Naze
- 2tphRS (Felixstowe Metro) Ipswich Westerfield Derby Road Trimley Felixstowe
- 2tphR Harwich Town Harwich International Ipswich Bury St. Edmunds Ely March Peterborough – Stamford – Oakham – Melton Mowbray – Leicester – Hinckley – Nuneaton – Coleshill Parkway – Birmingham New Street – University – Bromsgrove – Droitwich Spa – Worcester Shrub Hill
- 2tphRS (Bury St. Edmunds Metro) Ipswich Needham Market Stowmarket Elmswell Thurston Bury St. Edmunds (split/join) –:
  - Kennett Newmarket Dullingham Cambridge
  - $\, Kennett Soham Ely Manea March Whittlesey Peterborough$

Representative Hourly Non-Cross-Platform (but see Appendix C) Interchange Pattern at Marks Tey:

00H Liverpool Street – Clacton / Walton

RS Clacton / Walton - Sudbury

07H Clacton / Walton – Liverpool St. RS Sudbury – Clacton / Walton

- 15R Liverpool Street Clacton / Walton RS Clacton / Walton – Sudbury
- 23R Clacton / Walton Liverpool St. RS Sudbury – Clacton / Walton
- repeating at 30, 37, 45 and 53 minutes past.

Representative Hourly Non-Cross-Platform Interchange Pattern at Colchester:

00H Swansea – Euston Cross – Norwich via Diss H Liverpool Street – Clacton / Walton

- 07H Liverpool Street Harwich RS Sudbury – Clacton / Walton
- Bristol Temple Meads Euston Cross Norwich via Diss
   R Liverpool Street Clacton / Walton
- 23H Liverpool St Lowestoft
  - RS Sudbury Clacton / Walton

- repeating at 30, 37 and 45 minutes past.(not 50, and the Lowestoft service is only 1tph at this SP).

Representative Hourly Non-Cross-Platform Interchange Pattern at Ipswich:

- 00H Swansea Euston Cross Norwich via Diss (no connection)
- 15H Bristol Temple Meads ->] Euston Cross Norwich via Diss
  - R Harwich Town Worcester Shrub Hill
  - RS Ipswich-Felixstowe
  - RS Ipswich Cambridge / Peterborough
- 23H Liverpool St Lowestoft (no connection

- repeating at 30 and 45 minutes past (no 53 as Liverpool St.- Norwich is still just 1tph).

#### Service Plan 2A

This service plan comes into effect when HS11 opens to Faversham. The classic route thence- to Dover is

## Service Plan 2B

This service plan comes into effect when HS11 opens to Faversham. The classic route thence- to Dover is upgraded to 100mph and incorporated in HS11. The Southend Airport trains are extended, so the HS11 services are now (HS Metro):

- 2tphH [HS4 Cardiff Airport ->] Euston Cross Stratford HS South Shenfield HS Southend Airport Southend HS Grain Sheerness Faversham Canterbury East Dover Priory.
- 2tphH [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Stratford HS South Shenfield HS –Southend Airport – Southend HS – Grain – Sheerness – Faversham – Canterbury East – Dover Priory.

We assume the following RM services to North Kent and Dover:

- 2tphR Charing Cross Waterloo East London Bridge Ebbsfleet Rochester Chatham Gillingham – Rainham – Newington – Sittingbourne – Teynham – Faversham (split/join) –: – Whitstable – Chestfield and Swalecliffe – Herne Bay – Birchington on Sea – Westgate on Sea – Margate – Broadstairs – Dumpton Park – Ramsgate
   – Selling – Canterbury East – Bekesbourne – Adisham – Aylesham – Snowdown – Shepherd's Well – Kearsney – Dover Priory
- 2tphR Victoria Bromley South Strood Rochester Chatham Gillingham Rainham Newington Sittingbourne Teynham Faversham (split/join) –:
  - Whitstable Chestfield and Swalecliffe Herne Bay Birchington on Sea Westgate on Sea
    Margate Broadstairs Dumpton Park Ramsgate

– Selling – Canterbury East – Bekesbourne – Adisham – Aylesham – Snowdown – Shepherd's Well – Kearsney – Dover Priory

Representative Hourly Cross-Platform Connections at Faversham:

- 00H [HS4 Cardiff Airport ->] Euston Cross Dover
  - R Charing Cross Ramsgate / Dover Priory
- 15H [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Dover
  - R Victoria Ramsgate / Dover Priory

- repeating at 30 and 45 minutes past.

Service plan 2 overall imposes the following loadings on HS11:

•	Euston Cross	- Stratford HS South Junction	24tph
•	Stratford HS South Junction	- Manor Park Junction	8tph
•	Liverpool Street	- Manor Park Junction	7tph
•	Manor Park Junction	- Shenfield HS Junction	15tph
•	Shenfield HS Junction	- Southend Airport station	4tph
•	Southend Airport station	– Faversham station	4tph
•	Faversham station	– Dover Priory station	4tph

The 24tph between Euston Cross and Stratford HS South Junction are 16tph for HS2/HS1 (at HS2 SP4 / HS1 SP SP2) and 8 for HS4/HS7 (at HS4 SP2 / HS7 SP1) extending on to HS11. The section between
Faversham and Dover is classic route, merged into HS11. Only the HS11 services are given; there will be other, non-HS services.

It imposes the following loadings on HS12:

Shenfield HS Junction	- Shenfield North Junction	11tph
Shenfield North Junction	– Witham	11tph
Witham	– Colchester	9tph
Colchester	– Manningtree	7tph
Manningtree	- Pinewood Junction	5tph
Pinewood Junction	– Ipswich (GEML)	5tph
Ipswich (GEML)	– Norwich Thorpe via Diss	4tph
Pinewood Junction	- Woodbridge Junction	0tph
Ipswich (GEML)	– Belle Grove Junction	1tph
Belle Grove Junction	– Beccles Junction	1tph
Beccles Junction	– Lowestoft	1tph
Beccles Junction	– Norwich HS	0tph
	Shenfield HS Junction Shenfield North Junction Witham Colchester Manningtree Pinewood Junction Ipswich (GEML) Pinewood Junction Ipswich (GEML) Belle Grove Junction Beccles Junction	Shenfield HS Junction- Shenfield North JunctionShenfield North Junction- WithamWitham- ColchesterColchester- ManningtreeManningtree- Pinewood JunctionPinewood Junction- Ipswich (GEML)Ipswich (GEML)- Norwich Thorpe via DissPinewood Junction- Woodbridge JunctionIpswich (GEML)- Belle Grove JunctionBelle Grove Junction- Beccles JunctionBeccles Junction- LowestoftBeccles Junction- Norwich HS

### Service Plan 3

This service plan comes into use when the new infrastructure between Pinewood Junction and Norwich via Ipswich HS and Beccles opens, including new stations at Ipswich HS and Norwich HS, also the link at Reedham South Junction, allowing services to reach Yarmouth. Connections between HS4 and the Reading – Basingstoke route open, (they may well have opened earlier, but now come into full service,) enabling through services from South Western starting points (Bournemouth West, Plymouth via Salisbury and Salisbury itself) to become through services with HS12. (This is HS4 SP 2A.) The Bristol – Norwich service switches to the new route via Beccles. The Liverpool St. – Lowestoft service likewise now travels between Pinewood and Woodbridge junction, via Ipswich HS, where the new HS12 infrastructure diverges from the East Suffolk line. It then travels via the East Suffolk line to Belle Grove Junction, where the new HS12 route rejoins, as far as Beccles. This service now originates from Weymouth, with portions for both Yarmouth and Lowestoft, splitting / joining at Beccles, and has its frequency doubled to 2tph. The full service on HS12 is now:

HS12

UHS:

- 2tphH [HS4 Swansea ->] Euston Cross Stratford HS South Shenfield HS Chelmsford Colchester – Ipswich HS – Beccles – Norwich
- 2tphH [HS7/HS4 Bristol Temple Meads HS ->] Euston Cross Stratford HS South Shenfield HS Colchester Ipswich Diss Norwich
- 2tphH [HS4 Weymouth ->] Euston Cross Stratford HS South Shenfield HS Chelmsford Colchester – Ipswich HS – Woodbridge – Wickham Market – Saxmundham – Darsham – Halesworth – Brampton – Beccles (split/join) –: – Oulton Broad South – Lowestoft
  - Reedham South Berney Arms Yarmouth

 2tphH [HS4 Bournemouth West ->] Euston Cross – Stratford HS South – Shenfield HS – Chelmsford – Colchester – Manningtree – Mistley – Wrabness – Harwich Parkeston Quay – Dovercourt – Harwich Town

HS Metro:

- 2tphH [HS4 Plymouth via Salisbury ->] Euston Cross Stratford HS South Shenfield HS Chelmsford – Witham – Kelvedon – Marks Tey – Colchester – Wivenhoe – Thorp le Soken (splits/joins) – :
  - Clacton
  - Frinton Walton
- 2tphH [HS4 Salisbury ->] Euston Cross Stratford HS South Shenfield HS Chelmsford Witham White Notley Cressing Braintree Freeport Braintree

Representative Hourly Non-Cross-Platform (but see Appendix C) Interchange Pattern at Marks Tey:

- 00H [HS4 Plymouth via Salisbury ->] Euston Cross Clacton / Walton RS Clacton / Walton - Sudbury
- 07H Clacton / Walton Euston Cross [-> Plymouth via Salisbury HS4] RS Sudbury – Clacton / Walton
- 15R Liverpool Street Clacton / Walton RS Clacton / Walton – Sudbury
- 23R Clacton / Walton Liverpool St. RS Sudbury – Clacton / Walton
- repeating at 30, 37, 45 and 53 minutes past.

Representative Hourly Non-Cross-Platform Interchange Pattern at Colchester:

- 00H [HS4 Swansea ->] Euston Cross Norwich via Beccles H [HS4 Plymouth via Salisbury ->] Euston Cross - Clacton / Walton
- 07H [HS4 Bournemouth West ->] Euston Cross Harwich RS Sudbury - Clacton / Walton
- 15H [HS7/HS4 Bristol Temple Meads HS ->] Euston Cross Norwich via Diss
   R Liverpool Street Clacton / Walton
- 23H [HS4 Weymouth ->] Euston Cross Lowestoft / Yarmouth RS Sudbury – Clacton / Walton
- repeating at 30, 37, 45 and 53 minutes past.

Representative Hourly Non-Cross-Platform Interchange Pattern at Ipswich:

00H [HS4 Swansea ->] Euston Cross - Norwich via Beccles (no connection)

- 15H [HS7/HS4 Bristol Temple Meads HS ->] Euston Cross Norwich
  - R Harwich Town Worcester Shrub Hill
  - RS Ipswich-Felixstowe
  - RS Ipswich Cambridge / Peterborough
- 23H [HS4 Weymouth ->] Euston Cross Lowestoft / Yarmouth (no connection

- repeating at 30, 45 and 53 minutes past (the new Weymouth - Lowestoft / Yarmouth is 2tph).

Representative Hourly Non-Cross-Platform Interchange Pattern at Beccles:

00H [HS4 Swansea ->] Euston Cross - Norwich

H [HS4 Weymouth ->] Euston Cross – Lowestoft / Yarmouth

- repeating at 30 minutes past.

Service plan 3 imposes the following loadings on HS11:

•	Euston Cross	– Stratford HS South Junction	32tph
•	Stratford HS South Junction	– Manor Park Junction	16tph
•	Liverpool Street	– Manor Park Junction	0tph
•	Manor Park Junction	- Shenfield HS Junction	16tph
•	Shenfield HS Junction	- Southend Airport station	4tph
•	Southend Airport station	– Faversham station	4tph
•	Faversham station	– Dover Priory station	8tph

It imposes the following loadings on HS12:

•	Liverpool St.	<ul> <li>Shenfield GEML</li> </ul>	8tph
•	Shenfield GEML	- Shenfield North Junction	4tph
•	Shenfield HS Junction	- Shenfield North Junction	12tph
٠	Shenfield North Junction	– Witham	16tph
•	Witham	– Marks Tey	12tph
٠	Marks Tey	– Colchester	16tph
٠	Colchester	- Manningtree South Junction	8tph
•	Manningtree South Junction	- Manningtree North Junction	6tph
٠	Manningtree North Junction	– Pinewood Junction	8tph
•	Pinewood Junction	- Woodbridge Junction	4tph
•	Woodbridge Junction	– Belle Grove Junction HS12	2tph
٠	Woodbridge Junction	- Belle Grove Junction East Suffolk	2tph
٠	Belle Grove Junction	– Beccles Junction	4tph
•	Beccles Junction	– Lowestoft	2tph
٠	Beccles Junction	- Reedham South Junction	4tph
•	Reedham South Junction	– Yarmouth	2tph
•	Reedham South Junction	– Norwich HS	2tph

The extra 2tph between Beccles Junction and Reedham South Junction is the Yarmouth portion of the Weymouth – Lowestoft / Yarmouth service, which shares tracks with HS12 between those points.

#### Service Plan 3A

This service plan comes into use when HS7 opens between Bristol Temple Meads and Plymouth (HS7 SP2 / HS4 SP3). Its only effect here is that the Bristol – Norwich via Diss service now starts from Plymouth (indeed, from Cornwall).

#### Service Plan 3 Summary

It is worth summarising the full set of services at service Plan 3, as this represents the final, complete Mk1A state of these plans, and the services have so far been introduced piecemeal, at the various stages.

HS11 (all HS Metro):

- 2tphH [HS4 Cardiff Airport ->] Euston Cross Stratford HS South Shenfield HS Southend Airport Southend HS Grain Sheerness Faversham Canterbury East Dover Priory.
- 2tphH [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Stratford HS South Shenfield HS –Southend Airport – Southend HS – Grain – Sheerness – Faversham – Canterbury East – Dover Priory.

Regional Metro:

- 4tphRS Liverpool Street Stratford Shenfield Wickford Rayleigh Hockley Rochford Southend Airport Prittlewell Southend Victoria
- 2tphR Charing Cross Waterloo East London Bridge Ebbsfleet Rochester Chatham Gillingham – Rainham – Newington – Sittingbourne – Teynham – Faversham (split/join) –: – Whitstable – Chestfield and Swalecliffe – Herne Bay – Birchington on Sea – Westgate on Sea – Margate – Broadstairs – Dumpton Park – Ramsgate – Selling – Canterbury East – Bekesbourne – Adisham – Aylesham – Snowdown – Shepherd's
- Well Kearsney Dover Priory
  2tphR Victoria Bromley South Strood Rochester Chatham Gillingham Rainham Newington Sittingbourne Teynham Faversham (split/join) –:
  - Whitstable Chestfield and Swalecliffe Herne Bay Birchington on Sea Westgate on Sea
  - Margate Broadstairs Dumpton Park Ramsgate

– Selling – Canterbury East – Bekesbourne – Adisham – Aylesham – Snowdown – Shepherd's Well – Kearsney – Dover Priory

Representative Hourly Cross-Platform Connections at Southend Airport:

- 00H [HS4 Cardiff HS ->] Euston Cross Dover Priory
  - RS Liverpool Street Southend Victoria
- 15H [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Dover Priory
   RS Liverpool Street Southend Victoria
- repeating at 30 and 45 minutes past.

Representative Hourly Cross-Platform Connections at Faversham:

- 00H [HS4 Cardiff HS ->] Euston Cross Dover Priory
  - R Charing Cross Ramsgate / Dover Priory
- 15H [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Dover Priory
   R Victoria Ramsgate / Dover Priory

- repeating at 30 and 45 minutes past.

#### HS12:

UHS:

- 2tphH [HS4 Swansea ->] Euston Cross Stratford HS South Shenfield HS Chelmsford Colchester Ipswich HS Beccles Norwich
- 2tphH [HS7/HS4 Cornwall -> Plymouth ->] Euston Cross Stratford HS South Shenfield HS - Chelmsford - Colchester - Ipswich - Diss - Norwich
- 2tphH [HS4 Weymouth ->] Euston Cross Stratford HS South Shenfield HS Chelmsford Colchester – Ipswich HS – Woodbridge – Wickham Market – Saxmundham – Darsham – Halesworth – Brampton – Beccles (split/join) –:

– Oulton Broad South – Lowestoft

- Reedham South Berney Arms Yarmouth
- 2tphH [HS4 Bournemouth West ->] Euston Cross Stratford HS South Shenfield HS Chelmsford – Colchester – Manningtree – Mistley – Wrabness – Harwich Parkeston Quay – Dovercourt – Harwich Town

#### HS Metro:

 2tphH [HS4 Plymouth via Salisbury ->] Euston Cross – Stratford HS South – Shenfield HS – Chelmsford – Witham – Kelvedon – Marks Tey – Colchester – Wivenhoe – Thorp-le-Soken (splits/joins) – :

- Clacton

- Frinton Walton
- 2tphH [HS4 Salisbury ->] Euston Cross Stratford HS South Shenfield HS- Chelmsford Witham White Notley Cressing Braintree Freeport Braintree

#### Regional Metro:

- 2tphR Liverpool St. Shenfield GEML Ingatestone Chelmsford Hatfield Peverel Witham – Kelvedon – Marks Tey – Colchester – Wivenhoe – Thorp-le-Soken (splits/joins) – :
  - Clacton
  - Frinton Walton
- 2tphR Liverpool St. Shenfield GEML Ingatestone Chelmsford Hatfield Peverel Witham White Notley Cressing Braintree Freeport Braintree
- 4tphRS (Colne Valley Metro) Sudbury Bures Chappel & Wakes Colne Marks Tey Colchester – Colchester Town (reverse) – Hythe – Wivenhoe – Alresford – Great Bentley – Weeley – Thorpe-le-Soken (splits/joins) –

- Clacton

- Kirby Cross Frinton Walton-on-Naze
- 2tphRS (Felixstowe Metro) Ipswich Westerfield Derby Road Trimley Felixstowe
- 2tphR Harwich Town Harwich International Ipswich Bury St. Edmunds Ely March Peterborough – Stamford – Oakham – Melton Mowbray – Leicester – Hinckley – Nuneaton – Coleshill Parkway – Birmingham New Street
- 2tphRS (Bury St. Edmunds Metro) Ipswich Needham Market Stowmarket Elmswell Thurston – Bury St. Edmunds (split/join) –:
  - $\, Kennett New market Dulling ham Cambridge$
  - Kennett Soham Ely Manea March Whittlesey Peterborough

It is worth explaining the thinking behind the service pattern on HS12. It is split into logically separate categories, the UHS services and the HS Metro and associated RM(S) services.

The four UHS services serve the major cities and larger towns of East Anglia, and have an identical calling pattern between Euston Cross and Ipswich, except of course for the Harwich service, which calls at Manningtree rather than Ipswich, then all stations to Harwich Town. The service to Norwich via Diss calls at Ipswich GEML station (as does an associated RM service from Harwich to Worcester, and the local Bury St. Edmunds and Felixstowe Metros). The services to Norwich via Beccles and Lowestoft / Yarmouth via the East Suffolk line call at Ipswich HS station. The Norwich service connects cross-platform at Beccles with the Lowestoft and Yarmouth portions of the East Suffolk line service, which split / re-join there, thus providing a significantly faster service between London and Lowestoft / Yarmouth than the through service, whose primary purpose is to provide a through service between London and the East Suffolk line stations, and the above connecting service to Lowestoft and Yarmouth.

The two HS Metro services, together with the two RM services between Liverpool St. and Clacton / Walton and between Liverpool St. and Braintree, are intimately linked in with the Colne Valley Metro service, and together they provide the GEML stopping services between Shenfield and Colchester, of 4tph in total, and the service between London and the Colne Valley stations Sudbury, Bures and Chappel & Wakes Colne, by cross-platform connections at Marks Tey. Appendix C gives a suggested layout at Marks Tey to enable this contra-flow arrangement. Marks Tey is the hub of this group of services. The HS Metro and RM Clacton / Walton services provide an equal-interval stopping service of 4tph between Witham and Clacton / Walton, semi-fast between Colchester and Clacton / Walton. The Colne Valley Metro Sudbury – Clacton / Walton service is interspersed with these, and provides an all-stations service. The HS Metro and RM Braintree services provide an equal-interval stopping service between Shenfield and Witham. The HS Metro Clacton / Walton service connects cross-platform with the RM Braintree service at Witham, and the RM Clacton / Walton service connects with the HS Braintree service.

The station at Witham already has two island platforms, thus two platform faces in each direction. A new flyover will be required to connect trains from Braintree to the outer London line, but, other than that, the existing infrastructure should suffice. A schematic timetable is proposed, below. This is admittedly approximate, illustrative of the salient features of the plan, rather than exact timings. The timings are, however, reasonable, on the basis of calculations later, in the present article, and of existing timings in the current timetable.

Station \ Service	HS Clacton	RM Clacton	HS Braintree	RM Braintree	HS Clacton
Shenfield	00	13	15	28	30
Ingatestone		18		33	

Chelmsford	10	23	25	38	40
Hatfield Peverel		29		44	
Witham	20	35	35	50	50
Kelvedon	25	40			55
Marks Tey	30	45			60
Colchester	35	50			65
White Notley			40	55	
Cressing			43	58	
Braintree FP			46	61	
Braintree			50	65	

The Representative Hourly Cross-Platform Interchange Pattern at Witham (see above table):

- 00H [HS4 Plymouth via Salisbury ->] Euston Cross Clacton / Walton
  - R Liverpool St. Braintree
- 15H [HS4 Salisbury ->] Euston Cross Braintree
  - R Liverpool St. Clacton / Walton

- repeating at 30 and 45 minutes past.

The Representative Hourly Cross-Platform Interchange Pattern at Marks Tey is given below. Note that this is for both directions, since everything interconnects there:

- 00H [HS4 Plymouth via Salisbury ->] Euston Cross Clacton / Walton RS Clacton / Walton - Sudbury
- 07H Clacton / Walton Euston Cross [-> Plymouth via Salisbury HS4] RS Sudbury – Clacton / Walton
- 15R Liverpool St. Clacton / Walton RS Clacton / Walton – Sudbury
- 23R Clacton / Walton Liverpool St. RS Sudbury – Clacton / Walton

- repeating at 30, 37, 45 and 53 minutes past.

The existing layout at Colchester includes (i.e. it has a few more, but not relevant to the present argument) two island platforms, thus two platform faces in each direction. The outer faces are for services to and from Clacton / Walton – there is a dive-under east of the station for Clacton / Walton bound services. This very conveniently allows for the following Representative Hourly Cross-Platform Interchange Pattern at Colchester:

- 00H [HS4 Swansea ->] Euston Cross Norwich via Beccles
   H [HS4 Plymouth vis Salisbury ->] Euston Cross Clacton / Walton
- 07H [HS4 Bournemouth West ->] Euston Cross Harwich RS Sudbury - Clacton / Walton
- 15H [HS7/HS4 Connwall -> Plymouth ->] Euston Cross Norwich via Diss
   R Liverpool St. Clacton / Walton
- HS11/HS12 Route and Service Plans v5.0

23H [HS4 Weymouth ->] Euston Cross – Lowestoft / Yarmouth RS Sudbury – Clacton / Walton

- repeating at 30, 37, 45 and 53 minutes past.

At Ipswich, the Norwich via Beccles and Lowestoft / Yarmouth services use the (underground) HS station, while the Norwich via Diss and other services use the GEML station. On calculations presented later in this article, the Norwich service takes 16.5 minutes from Ipswich to Beccles nonstop, while the Lowestoft / Yarmouth service takes 59.5 minutes (with 7 stops). These calculsations include the standard 3 minutes wait per stop, which is certainly more than actually needed for small stations like many of those on the East Suffolk line. By reducing station wait times and other measures, it should easily be possible to reduce this time by 9 minutes to 50.5 minutes. In fact it is readily possible, and has in fact been done, as a consequence of the above considerations. Station times of 1 minute have been allowed at Melton, Wickham Market, Darsham, Brampton, Oulton Broad South, Reedham South and Berney Arms, and 2 minutes at Woodbridge, Saxmundham and Halesworth, thus saving 11 minute between Ipswich and Beccles, (and a further 2 minute to Lowestofe and 4 minutes to Yarmouth, in addition,) resulting in an Ipswich – Beccles time of 48.5 minutes. Thus, timing the Norwich train to depart Ipswich at 00 minutes and the Lowestoft / Yarmouth train at 23 minutes, then the Norwich train reaches Beccles at 16.5 minutes, and the Lowestoft / Yarmouth train reaches Beccles at 71.5 minutes, thus 55 minutes later. Thus timing departures from Ipswich at 00 and 23 minutes, the Lowestoft / Yarmouth train reaches Beccles around 5 minutes earlier than the Norwich train leaving Ipswich 60 minutes later, i.e. the second following train. (Hence it is surely unimaginable that Lowestoft and Yarmouth passengers will do other than take a Norwich train and change at Beccles. Only holidaymakers enjoying a deliberately leisurely journey, for whom, indeed, (like me,) the journey is an integral part of the holiday, would think of traveling to those destinations via the through service.)

Representative Hourly Non-Cross-Platform Interchange Pattern at Ipswich:

- 00H [HS4 Swansea ->] Euston Cross Ipswich HS Norwich via Beccles (no connection)
- 15H [HS7/HS4 Connwall -> Plymouth ->] Euston Cross Ipswich GEML Norwich via Diss
  - R Harwich Town Worcester Shrub Hill
  - RS Ipswich Felixstowe
  - $RS \ \ Ipswich-Cambridge \ / \ Peterborough$
- 23H [HS4 Weymouth ->] Euston Cross Lowestoft / Yarmouth (no connection

- repeating at 30, 45 and 53 minutes past (see Appendix D for elucidation of this interchange pattern of the Norwich via Diss service, as there is much hidden detail).

Representative Hourly Non-Cross-Platform Interchange Pattern at Beccles:

- 00H [HS4 Swansea ->] Euston Cross Norwich
  - H [HS4 Weymouth ->] Euston Cross Lowestoft / Yarmouth

- repeating at 30 minutes past.

### Estimated Journey Times

The conditions governing acceleration, deceleration, behaviour at junctions and line capacity of high speed lines are dealt with exhaustively in appendix B of the article 'Same Speed Railways'. Technically-minded readers, who want all the hard details, should look there. Only the required results are quoted here.

The following calculations are only approximate. Distances, to the nearest km, are derived from my own maps. However, comparing my estimated distances with actual distances, where these are appropriate, (thus Chelmsford – Colchester my estimate 34km, actual 35.2km, Colchester – Ipswich, my estimate 26km, actual 27.2km,) leads me to believe they are accurate to within 4%.

The crudest approximation, usually, is the assumption that, once line speed has been reached, that speed (300kph) is maintained until it becomes necessary to decelerate for a junction or a station stop. In fact, given the generally excellent alignments of this particular route, I am considerably more confident of this assumption than on certain other routes (Trans-Pennine, in particular).

The results are, in any case, valuable in giving a **feel** for the journey times possible.

My estimated distances (between stations) are:

•	Euston Cross – Stratford HS South	8km	(*)
•	Stratford HS South – Shenfield HS	26km	(300kph)
•	Shenfield HS – Southend Airport	27km	(300kph)
•	Southend Airport – Southend HS	4km	(*)
•	Southend HS – Grain	10km	(*)
•	Grain – Sheerness HS	6km	(*)
•	Sheerness HS – Faversham	16km	(300kph*)
•	Colchester – Ipswich HS	26km	(225kph)
•	Ipswich HS – Beccles	64km	(300kph)
•	Ipswich HS – Woodbridge	15km	(300kph*)
•	Beccles – Norwich	30km	(300kph)
•	Beccles – Reedham South	11km	(300kph*)

The above are all distances on HS11/HS12 new infrastructure. In addition, they share the following sections of classic routes, whose lengths are known exactly! (Refer to Appendix E.)

• Faversham – Canterbury East	15.8lm	(160kph)
• Canterbury East – Dover Priory	26.6km	(160kph)
• Shenfield – Chelmsford	15.4km	(225kph)
• Chelmsford – Witham	14.2km	(225kph)
• Witham – Kelvedon	5.9km	(225kph*)
• Kelvedon – Marks Tey	7.0km	(225kph*)
• Marks Tey – Colchester	7.8km	(225kph*)
• Chelmsford – Colchester	34.9km	(225kph)
Colchester – Manningtree	12.8km	(225kph)
• Manningtree – Ipswich GEML	15.0km	(225kph)
• Colchester – Ipswich GEML	27.8km	(225kph)
HS11/HS12 Route and Service Plans v5.0		

•	Ipswich GEML – Diss	42.2km	(225kph)
•	Diss – Norwich Thorpe	33.2km	(225kph)
•	Witham – White Notley	4.9km	(*)
•	White Notley – Cressing	1.8km	(*)
•	Cressing – Braintree Freeport	2.1km	(*)
•	Braintree Freeport – Braintree	1.9km	(*)
•	Colchester – Wivenhoe	7.3km	(160kph)
•	Wivenhoe – Thorpe-le-Soken	14.6km	(160kph)
•	Thorpe-le-Soken – Clacton	7.4km	(160kph)
•	Thorpe-le-Soken – Frinton	6.0km	(160kph)
•	Frinton – Walton	2.3km	(*)
•	Manningtree – Mistley	2.8km	(*)
•	Mistley – Wrabness	6.3km	(160kph)
•	Wrabness – Harwich Parkeston Quay	6.2km	(160kph)
•	Harwich Parkeston Quay – Dovercourt	2.1km	(*)
•	Dovercourt – Harwich Town	0.9km	(*)
•	Woodbridge – Melton	2.1km	(160kph*)
•	Melton – Wickham Market	6.8km	(160kph)
•	Wickham Market – Saxmundham	10.6km	(160kph)
•	Saxmundham – Darsham	7.0km	(160kph)
•	Darsham – Halesworth	8.4km	(160kph)
•	Halesworth – Brampton	6.3km	(160kph)
•	Brampton – Beccles	7.3km	(300kph*)
٠	Beccles – Oulton Broad South	10.3km	(160kph)
•	Oulton Broad South – Lowestoft	3.4km	(*)
•	Reedham South – Berney Arms	5.3km	(160kph)
•	Berney Arms – Yarmouth	7.5km	(160kph)

The line speeds are chosen as follows:

- HS11/HS12 new infrastructure has a line speed of 300kph
- The sections of classic route between Faversham and Dover Priory are merged into HS11, and upgraded to 160kph.
- The sections of classic route between Shenfield North and Pinewood junctions, also between Ipswich GEML and Norwich via Diss are merged into HS12, and upgraded to 225kph.
- Those sections marked (\*) are between Adjacent Stations, where the distance is insufficient for the line speed to be reached. The times between stations are given below, for a regime of acceleration switching to deceleration without any intervening steady speed. (Note that Bradford Central and Shipley are **not** adjacent stations, by just a few metres.)

Acceleration/deceleration distances and times (taken from 'Same Speed Railways' appendix B) are:

- Acceleration from stationary to 360kph, 225mph, takes 16.67km and 333 seconds
- Acceleration from stationary to 300kph, 187.5mph, takes 11.57km and 278 seconds
- Acceleration from stationary to 230kph, 143.8mph, takes 6.80km and 213 seconds
- Acceleration from stationary to 225kph, 140mph, takes 6.51km and 208 seconds

- Acceleration from stationary to 200kph, 125mph, takes 5.14km and 185 seconds
- Acceleration from stationary to 160kph, 100mph, takes 3.29km and 148 seconds
- Deceleration from 360kph to stationary takes 10.00km and 200 seconds
- Deceleration from 300kph to stationary takes 6.945km and 167 seconds
- Deceleration from 2300kph to stationary takes 4.08km and 128 seconds
- Deceleration from 225kph to stationary takes 3.91km and 125 seconds
- Deceleration from 200kph to stationary takes 3.07km and 111 seconds
- Deceleration from 160kph to stationary takes 1.98km and 89 seconds
- Time to travel from Euston Cross to Stratford HS South (start to stop) is 292 seconds
- Time to travel from Southend Airport to Southend HS (start to stop) is 207 seconds
- Time to travel from Southend HS to Grain (start to stop) is 327 seconds
- Time to travel from Grain to Sheerness HS (start to stop) is 253 seconds
- Time to travel from Sheerness HS to Faversham (start to stop) is 413 seconds
- Time to travel from Witham to White Notley (start to stop) is 229 seconds
- Time to travel from White Notley to Cressing (start to stop) is 138 seconds
- Time to travel from Cressing to Braintree Freeport (start to stop) is 150 seconds
- Time to travel from Braintree Freeport to Braintree (start to stop) is 142 seconds
- Time to travel from Witham to Kelvedon (start to stop) is 251 seconds
- Time to travel from Kelvedon to Marks Tey (start to stop) is 273 seconds
- Time to travel from Marks Tey to Colchester (start to stop) is 290 seconds
- Time to travel from Frinton to Walton (start to stop) is 157 seconds
- Time to travel from Manningtree to Mistley (start to stop) is 173 seconds
- Time to travel from Harwich Parkeston Quay to Dovercourt (start to stop) is 150 seconds
- Time to travel from Dovercourt to Harwich Town (start to stop) is 97 seconds
- Time to travel from Ipswich HS to Woodbridge (start to stop) is 400 seconds
- Time to travel from Woodbridge to Melton (start to stop) is 150 seconds
- Time to travel from Brampton to Beccles (start to stop) is 275 seconds
- Time to travel from Oulton Broad South to Lowestoft (start to stop) is 190 seconds
- Time to travel from Beccles to Reedham South (start to stop) is 343 seconds

The procedure in calculating journey times between station stops is to take the appropriate two values of acceleration / deceleration distance, and the two times, as given in initial lines of the above list, and sum them, thus, for a line speed of 360kph, acceleration / deceleration takes 16.67 + 10.00 = 26.67km and 333 + 200 = 533 seconds. The distance value is subtracted from the inter-station distance, and the remaining length is assumed to be travelled at line speed, taking time = distance / speed. This time is then added to the acceleration / deceleration time to obtain the actual journey time between the stations. This is all very laborious (error-prone, too!) to perform manually, so I have developed spreadsheets to do the work and present the results. (Adjacent Station times are added manually.) The various section times are accumulated to obtain the overall journey times. One further refinement: a standard wait time of 3 minutes is assumed at intermediate stations, and this is added into the accumulated time at each stop. Note however that a wait time of 7 or 8 minutes, rather than 3, is added at Beccles, for the service from Weymouth to Lowestoft and Yarmouth, to allow for the splitting / joining of portions there, and a difference of 1 minute in departure / arrival times of the portions. In practice, what this means (since the only times we are interested is those making a change at Beccles for both destinations) is the through service arrives at Beccles 2 minutes before the Swansea to Norwich service, and depart 2 (Lowestoft) or 3

(Yarmouth) minutes after it. Thus the wait times added at Beccles for Lowestoft and Yarmouth (with change out of the Norwich service) are 5 and 6 minutes respectively.

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Stratford HS South	8.0	8.0	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26.0	34.0	8.9	13.8	16.8
Shenfield HS - Southend Airport	27.0	61.0	9.1	22.9	28.9
Southend Airport - Southend HS	4.0	65.0	3.5	26.3	35.3
Southend HS - Grain	10.0	75.0	5.5	31.8	43.8
Grain - Sheerness HS	6.0	81.0	4.2	36.0	51.0
Sheerness HS - Faversham	16.0	97.0	6.9	42.9	60.9
Faversham - Canterbury East	15.8	112.8	7.9	50.8	71.8
Canterbury East - Dover Priory	26.6	139.4	12.0	62.8	86.8

### 1. Euston Cross – Dover (8 stops):

Current fastest time (minutes) from London [and the above values] to:

•	Shenfield	22		[17]
•	Southend Airport	52		[29]
•	Southend	51		[35]
•	Faversham	63	(Javelin)	[61]
•	Canterbury East	77	(56 to Canterbury West by Javelin)	[72]
•	Dover	83	(Javelin – 1 change)	[87]

## 2. Euston Cross – Norwich / Lowestoft / Yarmouth (6/7/8 stops)

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Stratford HS South	8.0	8.0	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26.0	34.0	8.9	13.8	16.8
Shenfield HS - Chelmsford	15.4	49.4	6.9	20.7	26.7
Chelmsford - Colchester	34.9	84.3	12.1	32.7	41.7
Colchester - Ipswich HS	26.0	110.3	9.7	42.4	54.4
Ipswich HS - Beccles	64.0	174.3	16.5	59.0	74.0
Beccles - Norwich	30.0	204.3	9.7	68.7	86.7
Beccles - Oulton Broad South	10.3	214.6	5.8	64.8	79.8
Oulton Broad South - Lowestoft	3.4	218.0	3.2	68.0	84.0
Beccles - Reedham South	11.0	185.3	5.7	64.7	80.7
Reedham South - Berney Arms	5.3	190.6	4.0	68.6	85.6
Berney Arms - Yarmouth	7.5	198.1	4.8	73.4	91.4
Ipswich HS - Woodbridge	15.0	125.3	6.7	49.1	64.1
Woodbridge - Melton	2.1	127.4	2.5	51.6	68.6
Melton - Wickham Market	6.8	134.2	4.5	56.1	74.1
Wickham Market - Saxmundham	10.6	144.8	6.0	62.1	81.1
Saxmundham - Darsham	7.0	151.8	4.6	66.7	87.7
Darsham - Halesworth	8.4	160.2	5.1	71.8	93.8
Halesworth - Brampton	6.3	166.5	4.3	76.2	100.2
Brampton - Beccles	7.3	173.8	4.6	80.7	105.7
Beccles - Oulton Broad South	10.3	184.1	5.8	86.6	116.6

Oulton Broad South - Lowestoft	3.4	187.5	3.2	89.7	120.7
Beccles - Reedham South	11.0	184.8	5.7	86.5	117.5
Reedham South - Berney Arms	5.3	190.1	4.0	90.4	122.4
Berney Arms - Yarmouth	7.5	197.6	4.8	95.2	128.2

The first entries for (stations to) Lowestoft and Yarmouth are by cross-platform connection at Beccles with the Norwich service. Both the Norwich and Lowestoft trains can depart Beccles simultaneously, and the Yarmouth portion immediately afterwards. Weyouth - Lowestoft/Yarmouth, serving the East Suffolk Line stations and splitting/joining at Beccles. The Yarmouth portion travels along HS12 until Reedham South Junction, then switches to the classic route to reach Yarmouth via Berney Arms. The second entries for Lowestoft and Yarmouth reflect the timings of the through train from Weymouth. These are unlikely to be much used as the Norwich train with changing at Beccles offers a significant time saving to Beccles and stations to Lowestoft and Yarmouth, as compared with the through service (which is of course intended to serve the East Suffolk Line stations). As originally calculate, with the standard wait time of 3 minutes at each station, the time taken to travel between Ipswich and Beccles via the East Suffolk line took c.43 minutes longer than the Norwich service via the new HS12 infrastructure. Given that most of the stations serve small locations, this has been respecified to provide a 1 minute wait time at Melton, Wickham Market, Darsham, Brampton, Oulton Broad South, Reedham South and Berney Arms, and a 2 minute wait time at Woodbridge, Saxmundham and Halesworth. As a consequence, 11 minutes are saved in station wait times between Ipswich and Beccles via the East Suffolk Line, so the journey now takes only 32 minutes longer than the Norwich service.

Current fastest time (minutes) from London [and the above values] to:

•	Shenfield	22	[17]
•	Chelmsford	32	[27]
•	Colchester	46	[42]
•	Ipswich	67	[54]
•	Beccles	145 (1 change)	[74]
•	Norwich	108	[87]
•	Lowestoft	155 (1 change at Norwich)	[84]
•	Yarmouth	159 (1 change at Norwich)	[91]
•	Woodbridge	92 (1 change)	[64]
•	Melton	96 (1 change)	[69]
•	Wickham Mkt	103 (1 change)	[74]
•	Saxmundham	113 (1 change)	[81]
•	Darsham	120 (1 change)	[88]
•	Halesworth	129 (1 change)	[94]
•	Brampton	136 (1 change)	[100]
•	Beccles	145 (1 change)	[106]

### 3. Euston Cross – Norwich (via Diss) / Harwich (7/9 stops)

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Stratford HS South	8.0	8.0	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26.0	34.0	8.9	13.8	16.8
Shenfield HS - Chelmsford	15.4	49.4	6.9	20.7	26.7
Chelmsford - Colchester	34.9	84.3	12.1	32.7	41.7
Colchester - Manningtree	12.8	97.1	6.2	38.9	50.9
Manningtree - Ipswich GEML	15.0	112.1	6.8	45.7	60.7
Ipswich GEML - Diss	42.2	154.3	14.0	59.7	77.7
Diss - Norwich Thorpe	33.2	187.5	11.6	71.3	92.3
Manningtree - Mistley	2.8	99.9	2.9	41.8	56.8
Mistley - Wrabness	6.3	106.2	4.3	46.1	64.1
Wrabness - Harwich Parkeston Quay	6.2	112.4	4.3	50.4	71.4
Harwich Parkeston Quay - Dovercourt	2.1	114.5	2.5	52.9	76.9
Dovercourt - Harwich Town	0.9	115.4	1.6	54.6	81.6

Current fastest time (minutes) from London [and the above values] to:

- Shenfield 22 [17]
- Chelmsford 32 [27]
- Colchester 46 [42]
- Manningtree 55 [51]
- Ipswich 67 [61]
- Diss 88 [78]
- Norwich 108 [92]
- Mistley 64(1 change) [57]
- Wrabness 69 (1 change) [64]
- Harwich P.Q. 77 (1 change) [71]
- Dovercourt 80 (1 change) [77]
- Harwich Town 82 (1 change) [82]

## 4. Euston Cross – Braintree / Clacton / Walton (9/9/10 stops)

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Stratford HS South	8.0	8.0	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26.0	34.0	8.9	13.8	16.8
Shenfield HS - Chelmsford	15.4	49.4	6.9	20.7	26.7
Chelmsford - Witham	14.2	63.6	6.6	27.2	36.2
Witham - White Notley	4.9	68.5	3.8	31.0	41.0
White Norley - Cressing	1.8	70.3	2.3	33.3	44.3
Cressing - Braintree Freeport	2.1	72.4	2.5	35.8	47.8
Braintree Freeport - Braintree	1.9	74.3	2.4	38.2	51.2
Witham - Kelvedon	5.9	69.5	4.2	31.4	41.4
Kelvedon - Marks Tey	7.0	76.5	4.6	36.0	47.0
Marks Tey - Colchester	7.8	84.3	4.8	40.8	52.8
Colchester - Wivenhoe	7.3	91.6	4.7	45.5	60.5
Wivenhoe - Thorpe- le-Soken	14.6	106.2	7.5	53.0	69.0
Thorpe-le-Soken - Clacton-on-Sea	7.4	113.6	4.8	57.7	76.7
Thorpe-le-Soken - Frinton-on-Sea	6.0	112.2	4.2	57.2	76.2
Frinton-on-Sea - Walton-on-the-Naze	2.3	114.5	2.6	59.8	79.8

Current fastest time (minutes) from London [and the above values] to:

•	Shenfield	22	[17]
•	Chelmsford	32	[27]
•	Witham	44	[36]
•	White Notley	53	[41]
•	Cressing	55	[44]
•	Braintree Freeport	58	[48]
•	Braintree	62	[51]
•	Kelvedon	49	[41]
•	Marks Tey	55	[47]
•	Colchester	46	[53]
•	Wivenhoe	65	[61]
•	Thorpe-le-Soken	77	[69]
•	Clacton	86	[77]
•	Frinton	87 (1 change)	[76]
•	Walton	91 (1 Change)	[80]

Note that the wait times at the various smaller stations –Witham, Kelvedon, Marks Tey, White Notley, Cressing, Braintree Freeport, Wivenhoe and Frinton have all been taken as 1 minute, rather than the usual 3, but 3 minutes at Thorpe-le-Soken because the Clacton and Walton portions split / join there.

### 3HS11/HS12 Mk2 Enhancements

This reinstates most but not all of the new infrastructure removed from the original Mk1 plans at Mk1A. Specifically:

HS11:

The new section between Faversham and Canterbury East is restored, giving a shorter distance and a 300kph line speed, but not that between Canterbury East and Dover Priory, which remains incorporated classic, with a 160kph line speed. One new estimated distance is involved:

• Faversham – Canterbury East 14km (300kph\*)

(\*) These are adjacent stations, at this line speed, and the time taken to travel between them (start to stop) is 386 seconds.

#### HS12:

The new infrastructure between Shenfield North and Colchester HS junctions is restored, giving essentially the same distances, since the new tracks follow the classic ones closely, but now with a 300kph line speed, but not that between Colchester HS and Pinewood junctions, which remains incorporated classic, with a 225kph line speed. No changes of distance are involved.

At this line speed, Shenfield and Chelmsford become adjacent stations, and the time taken to travel between them (start to stop) is 406 seconds.

The main justification for restoring the new infrastructure is to improve capacity and, equally importantly, reliability. The requirements are not severe – the maximum loading is only 16tph – **BUT** it isn't all same speed traffic, and this is very detrimental to capacity, and also reliability. Separating the 8tps UHS traffic onto its own tracks leaves the 8tps HS Metro and RM traffic, which also forms a very-nearly same-speed set by itself, with very ample capacity on the classic tracks.

I don't think a separate Colchester HS station is necessary; the existing infrastructure is entirely adequate. A new junction between HS12 and the central pair of tracks through the station, immediately to the west of the station allows the UHS traffic to continue on the upgraded GEML towards Ipswich, while the Classic tracks take the two outer platform faces, continuing on to Clacton / Walton by a dive-under, to the east of the station.

Service Plan 4 is the same as SP3, as far as the actual services are concerned. The only change is the segregation of traffic, as just described, and a slight (very!) acceleration between Shenfield and Colchester.

The loadings are now divided between HS12 Main Line and Classic Tracks, thus:

Service plan 3 imposes the following loadings on HS11:

•	Euston Cross	- Stratford HS South Junction	32tph
•	Stratford HS South Junction	– Manor Park Junction	16tph
•	Liverpool Street	– Manor Park Junction	0tph
•	Manor Park Junction	- Shenfield HS Junction	16tph
•	Shenfield HS Junction	- Southend Airport station	4tph
•	Southend Airport station	– Faversham station	4tph
•	Faversham station	– Dover Priory station	8tph

It imposes the following loadings on HS12:

٠	Liverpool St.	- Shenfield GEML	8tph	
٠	Shenfield GEML	- Shenfield North Junction	4tph	
•	Shenfield HS Junction	- Shenfield North Junction	12tph	
•	Shenfield North Junction	- Manningtree South Junction	8tph	(HS12)
٠	Shenfield North Junction	– Witham	8tph	(GEML)
•	Witham	– Marks Tey	4tph	(GEML)
٠	Marks Tey	- Colchester (East) Junction	8tph	(GEML)
٠	Manningtree South Junction	- Manningtree North Junction	6tph	
•	Manningtree North Junction	– Pinewood Junction	8tph	
٠	Pinewood Junction	- Woodbridge Junction	4tph	
•	Woodbridge Junction	– Belle Grove Junction HS12	2tph	
•	Woodbridge Junction	– Belle Grove Junction East Suffolk	2tph	
٠	Belle Grove Junction	– Beccles Junction	4tph	
•	Beccles Junction	– Lowestoft	2tph	
•	Beccles Junction	- Reedham South Junction	4tph	
٠	Reedham South Junction	– Yarmouth	2tph	
•	Reedham South Junction	– Norwich HS	2tph	

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Stratford HS South	8.0	8.0	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26.0	34.0	8.9	13.8	16.8
Shenfield HS - Southend Airport	27.0	61.0	9.1	22.9	28.9
Southend Airport - Southend HS	4.0	65.0	3.5	26.3	35.3
Southend HS - Grain	10.0	75.0	5.5	31.8	43.8
Grain - Sheerness HS	6.0	81.0	4.2	36.0	51.0
Sheerness HS - Faversham	16.0	97.0	6.9	42.9	60.9
Faversham - Canterbury East	14.0	111.0	6.4	49.3	70.3
Canterbury East - Dover Priory	26.6	137.6	12.0	61.3	85.3

## 1. Euston Cross – Dover (8 stops):

Current fastest time (minutes) from London [and the above values] to:

٠	Shenfield	22		[17]
•	Southend Airport	52		[29]
٠	Southend	51		[35]
•	Faversham	63	(Javelin)	[61]
٠	Canterbury East	77	(56 to Canterbury West by Javelin)	[70]
٠	Dover	83	(Javelin – 1 change)	[85]

## 2. Euston Cross – Norwich / Lowestoft / Yarmouth (6/7/8 stops)

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Stratford HS South	8.0	8.0	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26.0	34.0	8.9	13.8	16.8
Shenfield HS - Chelmsford	15.4	49.4	6.8	20.5	26.5
Chelmsford - Colchester	34.9	84.3	10.7	31.2	40.2
Colchester - Ipswich HS	26.0	110.3	9.7	40.9	52.9
Ipswich HS - Beccles	64.0	174.3	16.5	57.5	72.5
Beccles - Norwich	30.0	204.3	9.7	67.2	85.2
Beccles - Oulton Broad South	10.3	214.6	5.8	63.3	78.3
Oulton Broad South - Lowestoft	3.4	218.0	3.2	66.5	82.5
Beccles - Reedham South	11.0	185.3	5.7	63.2	84.2
Reedham South - Berney Arms	5.3	190.6	4.0	67.1	89.1
Berney Arms - Yarmouth	7.5	198.1	4.8	71.9	94.9
Ipswich HS - Woodbridge	15.0	125.3	6.7	47.6	62.6
Woodbridge - Melton	2.1	127.4	2.5	50.1	67.1
Melton - Wickham Market	6.8	134.2	4.5	54.6	72.6
Wickham Market - Saxmundham	10.6	144.8	6.0	60.6	79.6
Saxmundham - Darsham	7.0	151.8	4.6	65.2	86.2
Darsham - Halesworth	8.4	160.2	5.1	70.3	92.3
Halesworth - Brampton	6.3	166.5	4.3	74.7	98.7
Brampton - Beccles	7.3	173.8	4.6	79.2	104.2
Beccles - Oulton Broad South	10.3	184.1	5.8	85.1	115.1

Oulton Broad South - Lowestoft	3.4	187.5	3.2	88.2	119.2
Beccles - Reedham South	11.0	184.8	5.7	85.0	116.0
Reedham South - Berney Arms	5.3	190.1	4.0	88.9	120.9
Berney Arms - Yarmouth	7.5	197.6	4.8	93.7	126.7

The first entries for (stations to) Lowestoft and Yarmouth are by cross-platform connection at Beccles with the Norwich service. Both the Norwich and Lowestoft trains can depart Beccles simultaneously, and the Yarmouth portion immediately afterwards. 18 minutes is the current time Beccles – Lowestoft; with HS12 this would presumably be reduced as the connection would be with the HS service Weyouth – Lowestoft/Yarmouth, serving the East Suffolk Line stations and splitting/joining at Beccles. The Yarmouth portion travels along HS12 until Reedham South Junction, then switches to the classic route to reach Yarmouth via Berney Arms. The second entries for Lowestoft and Yarmouth reflect the timings of the through train from Weymouth. These are unlikely to be much used as the Norwich train with changing at Beccles offers a time saving of 43 minutes to Beccles and stations to Lowestoft and Yarmouth, as compared with the through service (which is of course intended to serve the East Suffolk Line stations).

Current fastest time (minutes) from London [and the above values] to:

•	Shenfield	22	[17]
•	Chelmsford	32	[25]
•	Colchester	46	[39]
•	Ipswich	67	[51]
•	Beccles	145 (1 change)	[71]
•	Norwich	108	[84]
•	Lowestoft	155 (1 change at Norwich)	[88]
•	Yarmouth	159 (1 change at Norwich)	[97]

#### 3. Euston Cross – Norwich (via Diss) / Harwich (7/9 stops)

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Stratford HS South	8.0	8.0	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26.0	34.0	8.9	13.8	16.8
Shenfield HS - Chelmsford	15.4	49.4	6.8	20.5	26.5
Chelmsford -	34.9	84.3	10.7	31.2	40.2

Colchester					
Colchester - Manningtree	12.8	97.1	6.2	37.4	49.4
Manningtree - Ipswich GEML	15.0	112.1	6.8	44.2	59.2
Ipswich GEML - Diss	42.2	154.3	14.0	58.2	76.2
Diss - Norwich Thorpe	33.2	187.5	11.6	69.9	90.9
Manningtree - Mistley	2.8	99.9	2.9	40.3	55.3
Mistley - Wrabness	6.3	106.2	4.3	44.6	62.6
Wrabness - Harwich Parkeston Quay	6.2	112.4	4.3	48.9	69.9
Harwich Parkeston Quay - Dovercourt	2.1	114.5	2.5	51.4	75.4
Dovercourt - Harwich Town	0.9	115.4	1.6	53.1	80.1

Current fastest time (minutes) from London [and the above values] to:

•	Shenfield	22	[17]
•	Chelmsford	32	[27]
•	Colchester	46	[40]
•	Manningtree	55	[49]
•	Ipswich	67	[59]
•	Diss	88	[76]
•	Norwich	108	[91]
•	Mistley	64 (1 change)	[55]
•	Wrabness	69 (1 change)	[63]
•	Harwich P.Q.	77 (1 change)	[70]
•	Dovercourt	80 (1 change)	[75]
•	Harwich Town	82 (1 change)	[80]

There are no changes at Mk2 in the timings to Braintree, Clacton and Walton.

# Appendix A – Euston Cross and the Inter-Regional Connections

### General

By routing the classic-compatible services of HS2 and HS4 into Euston and Paddington, respectively, and all the GC-gauge services of both routes through Euston Cross, and on to HS1 and HS11/HS12, superlative cross-London inter-regional HS services are enabled, between the West Midlands / North West and Kent / East Sussex, and between South Wales / West Country and North Kent / East Anglia. The classic compatible services of HS1 (there's only one) and HS11/HS12 are likewise routed into St. Pancras East (the 'Javelin' platforms) and Liverpool Street respectively. The GC-gauge services of HS1 (not the international ones) and HS11/HS12 balance exactly those of HS2 and HS4. There is thus no need for any rebuilding work at the four terminal stations to accommodate GC-gauge trains. (Euston certainly needs rebuilding because it's such a disgusting mess, but it need not expand significantly beyond its current footprint, Paddington needs nothing more than a good clean and a fresh coat of paint, St. Pancras and Liverpool Street probably need nothing at all.) Given the GC-gauge loadings of the London end of HS2 and HS1 (12tph) and of HS4 and HS11/HS12 (6tph) - these are at the final service plans of each route -a single tunnel in each direction, with a minimum of 6 platforms, (passive provision for 8,) at Euston Cross, would suffice. That a single Euston Cross station, with a single pair of approach tunnels, would serve two HS inter-regional routes should seriously enhance its business case. I would like to see passive provision for 8 platforms, as is indicated in the diagrams.

The following sections illustrate the significant locations on the Euston Cross cross-London, interregional route. The track diagrams all use the colour scheme:

HS1	
HS2	
HS4	
HS11	
Crossrail	
WCML	
GWML	

#### Old Oak Common

Old Oak Common station is on two levels, (3 actually, including London Overground, but that, although important, is not relevant in the current context):

Ground Level, consisting of three sets of four platforms, serving the routes:

- GWML (Classic, long distance, and Heathrow Shuttle services,) on the fast lines
- HS4 Classic Compatibles and Chiltern Line services on the relief lines, both of which diverge immediately west of the platforms, the CCs to join HS4 at Old Oak Common West Junction, at the low level and the Chiltern Line services to Northolt Junction

• Crossrail, of which the arm to the WCML and the Stratford Shuttle reversing sidings diverges immediately west of the platforms, and the GWML arm takes over the relief lines

Low Level, consisting of HS2 (all services, so variable platforms will be required) and HS4 (GC-gauge services).

Ideally, these should be one above the other, with the passenger entrances and circulating area between them, with lifts, escalators and stairs directly to all platforms. In order for HS2 and HS4 GC-gauge services to share the same pair of tracks, the classic-compatible services must first diverge, those of HS4 **before** the LL station (heading east), at Old Oak Common West Junction (then using the GWML platforms at ground level), and those of HS2 immediately after the LL station, at Old Oak Common North Junction. HS2 and HS4 merge shortly after that, at Old Oak Common East Junction. HS2's London-bound classic-compatible trains join the WCML at Queens Park Junction. In the original Euston Cross plans, this was seen as actually at Queens Park (since there was then no need to get them off HS2 as soon as possible after Old Oak Common). In fact Queens Park Junction (I'll keep the name as it's already in the literature) would best be located immediately west of the Kensal Green tunnels – there's plenty of room for it there, and it's only about <sup>1</sup>/<sub>2</sub> mile from Old Oak Common North Junction.



Euston Cross

This is trivial, a two track route widening to serve 6 platforms. The middle two platform faces would ordinarily be served by HS4 trains, and the two outer pairs by HS2.



### Stratford HS South

HS2/HS4 follow, in tunnel, the alignment of HS1, but a little to the south of it, from north of St. Pancras to Stratford. Thus whereas HS1/HS6 arrive at Stratford HS North station (the former Stratford International, which it never was,) HS2/HS4 arrive at Stratford HS South station, underneath Stratford (Regional) station. This is similar to Euston Cross – the route widens to serve 6 platforms, with HS4 occupying the middle two – but afterwards the HS4 tracks diverge from the HS2 tracks at Stratford HS South Junction, and HS4 metamorphoses into route HS11. The scissors crossovers are provided for operational flexibility but should not normally be used.

HS11 emerges from tunnel on the north side of the GEML and is joined by a connection from the classic route, at Manor Park Junction.

HS2 continues to Woodgrange Road Junction in Forest Gate, where it merges with HS1.

Stratford HS South corresponds in many respects to Old Oak Common. Both are served by all the GCgauge inter-regional services, and afford convenient interchange with Crossrail. The Crossrail tracks are likewise in the high level station, having taken over the former slow lines, thus providing cross-platform interchange with the LT Central Line. Stratford HS South is on the Shenfield branch of Crossrail, and thus has a 12tph service, but additionally is served by the 8tph shuttle between Stratford and Old Oak Common.



# Appendix B – Track Layouts at Beccles and Reedham South Junctions

HS12 and the East Suffolk Line share tracks between Belle Grove and Beccles Junctions. HS12 and the Yarmouth branch of the East Suffolk Line further share tracks (on a new alignment) between Beccles and Reedham South Junctions.



The Norwich service would normally occupy the inside tracks and the Lowestoft and Yarmouth portions (splitting/joining at Beccles) the outer. But scissors crossovers are provided for operational flexibility.



# Appendix C – Cross-Platform Interchange at Marks Tey

The requirement at Marks Tey is to provide cross-platform interchange between London and Sudbury, and vice versa. This is possible by a contraflow arrangement (compare with HS3 and Tees Valley Metro interchange at Darlington), but whether or not it would be worthwhile is arguable. HS12 crosses the GEML south of the station, and the down track of the Colne Valley Metro shares the bridge.



#### **To Colchester**

# Appendix D – Interchange at Ipswich

The classic station at Ipswich is an appalling mess – inadequate provision on a cramped site with no scope for expansion. (It's not in a very convenient location for the city it purports to serve, either, but there are many worse.) The HS station is located underneath it because there's no room for it anywhere else; this does also allow for a nice alignment, avoiding all the congestion of Ipswich and its junctions.

Ipswich currently has 3 through platforms and one bay. There is an existing siding on the south side which could serve another terminating platform. The current layout, simplified to show only the features relevant to the present argument, is:



Platforms 1-4 exist already, with those numbers. Platform 5 is new, but on an existing siding.

In order to provide each-way connections between two through services, with only three through platforms available, at least one platform must provide for reversible working. Platform 3 is selected as the reversible platform, because of the existing crossovers 'A', which allow it to be used for Harwich-bound trains without impact on the route through platform 4. Platform 4 is currently used by stopping services to destinations such as Cambridge. This function is taken over by platform 5, access to which is by crossover and connection 'C', and platform 4 then serves the down HS12 classic compatible service to Norwich, via connections 'B'. Platform 2 serves the up London trains, (HS12 classic-compatible service from Norwich), as it does at present. Platform 1 currently serves the Felixtowe and East Suffolk Line services. The latter becomes an HS12 classic-compatible service from London, and uses the underground HS station. Trains can reach Felixstowe without using the classic GEML, so the line into platform 1 is shown in the above diagram as completely disconnected.

The complete (because it has to provide for both directions) hourly interchange pattern at Ipswich is:

- 00H Norwich Liverpool Street (platform 2)
  - R Birmingham New St. Harwich Town (platform 3)
  - RS Cambridge / Peterborough Ipswich (platform 5)
  - RS Felixstowe Ipswich (platform 1)
- 10H Liverpool Street Norwich (platform 4)
  - R Harwich Town Birmingham New St. (platform 3)
  - RS Ipswich Cambridge / Peterborough (platform 5)
  - RS Ipswich Felixstowe (platform 1)
- repeating at 30 and 40 minutes past.

Note how the all-stations services from Cambridge and Felixstowe connect into the fast services to London and Harwich, and how the fast services from London and Harwich connect into them. The services from Cambridge and Fexlixstowe have a 10 minute layover in Ipswich (actually a few minutes longer, 15 minutes say, as they arrive before the up through services, and depart after the down throughs). The up London service arrives before the up Harwich, and departs after it, likewise for the down services. This, obviously, is because they share the same GEML track either side of Ipswich, and also because I regard it as good practise to minimise the occupancy of a reversible track. Hence the Harwich trains have the shortest wait time at Ipswich (passengers from the other services will already be waiting for them at platform 3, and passengers changing from the Harwich trains have time to reach the others. In the down direction, though not in the up, London – Norwich and Harwich – Birmingham actually have a cross-platform connection!

(This interchange could indeed advantageously be implemented immediately, involving just classic services.)

# Appendix E – Route Changes at Mk1A

The changes on HS11 are particularly simple to describe – the section between Faversham and Dover is now merged with the classic Chatham route. At Mk2, the original design between Faversham and Canterbury East is reinstated, but the section thence to Dover could well remain incorporated classic.

On HS12 the changes are likewise simple – the section from Shenfield North Junction to Ipswich is merges with the classic GEML. The section of new infrastructure between Pinewood Junction and Norwich via the new Ipswich HS station and Beccles, together with the connections at Reedham to accommodate the Yarmouth service, is retained. At Mk2, the original design of new infrastructure between Shenfield North Junction and Colchester HS Junction is reinstated, but the section thence to Pinewood Junction could well remain incorporated classic.

# Appendix E – Distance Table for Kent and East Anglia

Distance Table for HS11/HS12					
Farnborough to:	miles:chains	km			
Canterbury East	9:68	15.8			
Dover Priory	26:29	42.4			
Liverpool St. to:	miles:chains	km			
Shenfield	20:16	32.5			
Ingatestone	23:50	38.0			
Chelmsford	29:60	47.9			
Hatfield Peverel	35:74	57.8			
Witham	38:47	62.1			
White Notley	41:50	67.0			
Cressing	42:60	68.8			
Braintree Freeport	44:06	70.9			
Braintree	44:75	72.3			
Kelvedon	42:21	68.0			
Marks Tey	46:49	75.0			
Colchester	51:37	82.8			
Wivenhoe	56:00	90.1			
Thorpe-le-Soken	65:07	104.7			
Clacton-on-Sea	69:56	112.1			
Frinton-on-Sea	68:66	110.7			
Walton-on-the-Naze	70:15	113.0			
Manningtree	59:35	95.6			
Mistley	61:14	98.4			
Wrabness	65:06	104.7			
Harwich Parkeston Quay	68:72	110.9			
Dovercourt	70:19	113.0			
Harwich Town	70:61	113.9			
Ipswich	68:59	110.6			
Diss	94:79	152.8			
Norwich	114:77	185.0			
Westerfield Junction	72:23	116.3			
Woodbridge	79:00	127.1			
Melton	80:26	129.2			
Wickham Market	84:43	136.0			
Saxmundham	91:08	146.6			
Darsham	95:35	153.6			
Halesworth	100:53	162.0			
Brampton	104:49	168.3			
Beccles	109:11	175.6			
<b>Oulton Broad South</b>	115:42	185.9			
Lowestoft	117:54	189.3			
Reedham South to:	miles:chains	km			

Berney Arms (*)	3:23	5.3
Yarmouth	7:77	12.8

The source of these data is 'Track Atlas of Mainland Britain' (TRACKmaps 2009). The values are given in miles and chains (80 chains = 1 mile). In contrast to most other exercises of this type, the East Anglia distances were all utterly trivial to derive – all given explicitly from Liverpool St. The Kent distances were also trivial – both from the same datum. But it was still a sufficiently tedious process to make it worth preserving the results, so that I don't ever have to do it again.

# Appendix Q – Journey Times for Line Speed 225kph, 140mph

The article 'Line Capacity vs. Speed for High Speed Railways' points out (in the section 'Consequences of the Results') that a good case can be made for a line speed of 225kph, 140mph, because this offers a good compromise between speed and line capacity (theoretical capacity 49tph at 225kph with basic Train Separation Distance as compared with 29tph at 360kph with extended TSD). Even more important is the fact that this is just within the current (as at 2014) Turnout Limit Speed of 230kph, 144mph. This is the maximum speed at which trains can diverge from the main line of a HS railway, using the fastest available pointwork. What this means is that diverging trains can leave the main line at full line speed; there is no need to decelerate on the main line before diverging. This means that the Extended Train Separation Distance standard, which allows diverging trains to decelerate on the main line, without affecting a following straight-ahead train, which continues at full line speed, is no longer necessary, which allows major simplification in the operation of HS railways.

This new appendix Q is being added to every Route and Service Plans article, to show what the effect would be for the journey times of the various services. No recommendation is actually being made for this change, but it is important that the supporting information be available to allow a reasoned decision to be made.

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Stratford HS South	8.0	8.0	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26.0	34.0	9.7	14.6	17.6
Shenfield HS - Southend Airport	27.0	61.0	10.0	24.6	30.6
Southend Airport - Southend HS	4.0	65.0	3.5	28.0	37.0
Southend HS - Grain	10.0	75.0	5.5	33.5	45.5
Grain - Sheerness HS	6.0	81.0	4.2	37.7	52.7
Sheerness HS - Faversham	16.0	97.0	6.9	44.6	62.6
Faversham - Canterbury East	14.0	111.0	6.4	51.0	72.0
Canterbury East - Dover Priory	26.6	137.6	12.0	62.9	86.9

## 1. Euston Cross – Dover (8 stops):

Current fastest time (minutes) from London [and the Mk2 times values] {and the above values} to:

•	Shenfield	22		[17]	{18}
•	Southend Airport	52		[29]	{31}
•	Southend	51		[35]	{37}
•	Grain			[44}	{46}
•	Sheerness HS			[53]	{53}
•	Faversham	63	(Javelin)	[61]	<i>{</i> 63 <i>}</i>
•	Canterbury East	77	(56 to Canterbury West by Javelin)	[70]	{72}
•	Dover	83	(Javelin – 1 change)	[85]	{87}

## 2. Euston Cross – Norwich / Lowestoft / Yarmouth (6/7/8 stops)

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Stratford HS South	8.0	8.0	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26.0	34.0	9.7	14.6	17.6
Shenfield HS - Chelmsford	15.4	49.4	6.8	21.3	27.3
Chelmsford - Colchester	34.9	84.3	12.1	33.4	42.4
Colchester - Ipswich HS	26.0	110.3	9.7	43.1	55.1
Ipswich HS - Beccles	64.0	174.3	19.8	63.0	78.0
Beccles - Norwich	30.0	204.3	10.8	73.8	91.8
Beccles - Oulton Broad South	10.3	214.6	5.8	68.8	83.8
Oulton Broad South - Lowestoft	3.4	218.0	3.2	72.0	88.0
Beccles - Reedham South	11.0	185.3	5.7	68.7	89.7
Reedham South - Berney Arms	5.3	190.6	4.0	72.7	94.7
Berney Arms - Yarmouth	7.5	198.1	4.8	77.5	100.5
Ipswich HS - Woodbridge	15.0	125.3	6.7	49.8	64.8
Woodbridge - Melton	2.1	127.4	2.5	52.3	69.3
Melton - Wickham Market	6.8	134.2	4.5	56.8	74.8
Wickham Market - Saxmundham	10.6	144.8	6.0	62.8	81.8
Saxmundham - Darsham	7.0	151.8	4.6	67.4	88.4
Darsham - Halesworth	8.4	160.2	5.1	72.5	94.5
Halesworth - Brampton	6.3	166.5	4.3	76.8	100.8
Brampton - Beccles	7.3	173.8	4.6	81.4	106.4
Beccles - Oulton Broad South	10.3	184.1	5.8	87.3	117.3
Oulton Broad South - Lowestoft	3.4	187.5	3.2	90.4	121.4
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Beccles - Reedham South	11.0	184.8	5.7	87.1	118.1
Reedham South - Berney Arms	5.3	190.1	4.0	91.1	123.1
Berney Arms - Yarmouth	7.5	197.6	4.8	95.9	128.9

 $Current \ fastest \ time \ (minutes) \ from \ London \ [and the \ Mk2 \ times \ values] \ \{and \ the \ above \ values\} \ to:$ 

•	Shenfield	22	[17]	{18}
•	Chelmsford	32	[25]	{27}
•	Colchester	46	[39]	<i>{</i> 42 <i>}</i>
•	Ipswich	67	[51]	{55}
•	Beccles	145 (1 change)	[71]	{78}
•	Norwich	108	[84]	<i>{</i> 92 <i>}</i>
•	Lowestoft	155 (1 change at Norwich)	[88]	{88}
•	Yarmouth	159 (1 change at Norwich)	[97]	{101}

## 3. Euston Cross – Norwich (via Diss) / Harwich (7/9 stops)

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Stratford HS South	8.0	8.0	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26.0	34.0	9.7	14.6	17.6
Shenfield HS - Chelmsford	15.4	49.4	6.9	21.5	27.5
Chelmsford - Colchester	34.9	84.3	12.1	33.5	42.5
Colchester - Manningtree	12.8	97.1	6.2	39.7	51.7
Manningtree - Ipswich GEML	15.0	112.1	6.8	46.5	61.5
Ipswich GEML - Diss	42.2	154.3	14.0	60.5	78.5
Diss - Norwich Thorpe	33.2	187.5	11.6	72.2	93.2
Manningtree - Mistley	2.8	99.9	2.9	42.6	57.6
Mistley - Wrabness	6.3	106.2	4.3	47.0	65.0
Wrabness - Harwich Parkeston Quay	6.2	112.4	4.3	51.3	72.3
Harwich Parkeston Quay - Dovercourt	2.1	114.5	2.5	53.8	77.8
Dovercourt - Harwich Town	0.9	115.4	1.6	55.4	82.4

Current fastest time (minutes) from London [and the Mk2 times] {and the above values} to:

•	Shenfield	22	[17]	{18}
•	Chelmsford	32	[27]	{28}
•	Colchester	46	[40]	{ <b>43</b> }
•	Manningtree	55	[49]	{52}
•	Ipswich	67	[59]	<i>{</i> 62 <i>}</i>
•	Diss	88	[76]	<b>{79}</b>
•	Norwich	108	[91]	<b>{91}</b>
•	Mistley	64 (1 change)	[55]	{58}
•	Wrabness	69 (1 change)	[63]	<i>{</i> 65 <i>}</i>
•	Harwich P.Q.	77 (1 change)	[70]	{72}
•	Dovercourt	80 (1 change)	[75]	{78}
•	Harwich Town	82 (1 change)	[80]	{52}

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